

[JP,2001-311090,A]

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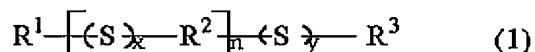
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CLAIMS

[Claim(s)]

[Claim 1] The lubricating oil constituent characterized by coming to carry out 0.01-10.0 mass % content of the polysulfide compound expressed with the following type (1) to lubricating oil base oil on constituent whole-quantity criteria.

[Formula 1]

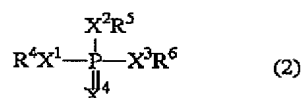


(Among a formula (1), R1 and R3 are the alkyl groups or alkenyl radicals of carbon numbers 6-30, may be the same respectively or may differ.) Moreover, R2 shows the alkylene group of carbon numbers 6-30. x and y are 1-15 independently, respectively, and n is 0-2.

[Claim 2] It is the lubricating oil constituent according to claim 1 which R1 and R3 are the alkyl groups or alkenyl radicals of carbon numbers 10-30 among a formula (1), and is characterized by R2 being the alkylene group of carbon numbers 10-30.

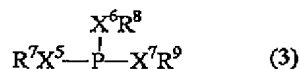
[Claim 3] The lubricating oil constituent characterized by coming to carry out 0.005-0.5 mass % content of the mixture of one sort of compounds chosen in a lubricating oil constituent according to claim 1 or 2 from the derivatives of the phosphoric ester further expressed with the following type (2), the phosphite expressed with the following type (3), and these Lynn system compound, or two or more sorts of compounds on constituent whole-quantity criteria as an amount of Lynn elements.

[Formula 2]



(R4, R5, and R6 show a hydrogen atom or the hydrocarbon group of carbon numbers 1–30 according to an individual among a formula (2), respectively, and at least one of R4, R5, and R6 is a hydrocarbon group, and X1, X2, X3, and X4 show an oxygen atom or a sulfur atom according to an individual, respectively.)

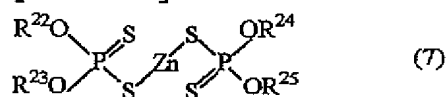
[Formula 3]



(R7, R8, and R9 show a hydrogen atom or the hydrocarbon group of carbon numbers 1–30 according to an individual among a formula (3), respectively, and at least one of R7, R8, and R9 is a hydrocarbon group, and X5, X6, and X7 show an oxygen atom or a sulfur atom according to an individual, respectively.)

[Claim 4] The lubricating oil constituent characterized by coming to carry out 0.05–5.0 mass % content of the dithiophosphate zinc further expressed with the following type (7) on constituent whole-quantity criteria in a lubricating oil constituent according to claim 1, 2, or 3.

[Formula 4]



(R22, R23, R24, and R25 show the alkyl group of carbon numbers 1–18, an aryl group, or the alkyl aryl radical of carbon numbers 7–18 according to an individual among a formula (7), respectively.)

[Claim 5] The lubricating oil constituent according to claim 1, 2, 3, or 4 characterized by being an object for stick shifts, or a lubricating oil for automatic transmissions.

[Claim 6] The lubricating oil constituent according to claim 1, 2, 3, or 4 characterized by being a tractor and a lubricating oil for common lubrication for construction equipments.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention has the outstanding friction property and its durability in detail about a lubricating oil constituent, and relates to the lubricating oil constituent used for a device with the part which receives effect especially by friction. It is related with the lubricating oil constituent suitable for especially the use as a lubricating oil for power transmission devices, such as a lubricating oil for common lubrication which carries out the lubrication of the change gear specifically used for the object for stick shifts or the lubricating oil for automatic transmissions which used the synchronizer ring, a tractor, or a construction equipment, and the brake to coincidence.

[0002]

[Description of the Prior Art] Generally the additive which uses the sulfur system additive called SP system additive and the Lynn system additive as a principal component is used for gear oil. This is because this additive has the engine performance excellent in the abrasion resistance called an extreme pressure property or printing-proof nature. However, if there is no dynamic friction coefficient sufficient between a synchronizer ring and a gear cone at the time of gear change, it does not synchronize easily, but gear change takes time amount or too much force is needed in the hand control for automobiles or the automatic transmission which used the synchronizer ring for the synchromesh device, for gear change actuation. Moreover, if the coefficient of static friction between a synchronizer ring and a gear cone is high at the time of gear change, it will be easy to produce the fault called connection. When this needs to let a little the synchronizer ring which once stood it still slide on a gear cone at the time of gear change actuation and the coefficient of static friction at this time is high, it is for connection to occur.

[0003] It is known that SP system additive currently used conventionally will worsen this friction property. In order that especially the well-known polysulfide that is one of the principal components of SP system additive might promote wear of a copper system synchronizer ring, the rapid fall of a dynamic friction coefficient was caused, and since a coefficient of static friction was also very high, gear change operability sufficient in the hand control of SP system additive system or the lubricating oil constituent for automatic transmissions was not acquired. On the other hand, in a

tractor or a construction equipment, the common lubrication which carries out lubrication to the lubricating oil with the same brake of a change gear and a wheel is almost the case. For this reason, the engine performance of brake-noise prevention is required of the lubricating oil to be used at the high extreme pressure property and the coincidence as gear oil. A brake noise is generated by the stick slip or self-excited vibration of a wet oiling brake (brake using a wet friction device). In order to prevent this, the lubricating oil constituent with which the friction regulator with the property which lowers coefficient of friction on low-speed slipping conditions more was added is used. However, the conventional object for tractors or the engine performance of a construction machine-fluid constituent was not enough, and often produced the brake noise, and the claim of a product had generated it.

[0004]

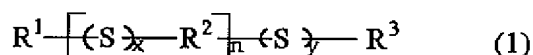
[Problem(s) to be Solved by the Invention] Then, this invention is made in view of such the actual condition, and especially the purpose is in offering the lubricating oil constituent suitable for the use as lubricating oils for power transmission devices, such as the stick shift oil or automatic-transmission oil of an automobile, a tractor, and a lubricating oil for common lubrication of a construction equipment, which has the outstanding extreme pressure property and a friction property.

[0005]

[Means for Solving the Problem] That is, this invention is a lubricating oil constituent characterized by coming to carry out 0.01–10.0 mass % content of the polysulfide compound expressed with the following general formula (1) to lubricating oil base oil on constituent whole-quantity criteria.

[0006]

[Formula 5]



(Among a formula (1), R¹ and R³ are the alkyl groups or alkenyl radicals of carbon numbers 6–30, may be the same respectively or may differ.) Moreover, R² shows the alkylene group of carbon numbers 6–30. x and y are 1–15 independently, respectively, and n is 0–2.

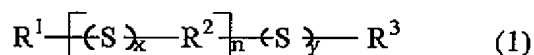
[0007]

[Embodiment of the Invention] Hereafter, the contents of this invention are further explained to a detail. The lubricating oil constituent of this invention does 0.01–10.0 mass % content of the polysulfide compound expressed with the (A) following general

formula (1) to lubricating oil base oil on constituent whole-quantity criteria.

[0008]

[Formula 6]



(Among a formula (1), R1 and R3 are the alkyl groups or alkenyl radicals of carbon numbers 6–30, may be the same respectively or may differ.) Moreover, R2 shows the alkylene group of carbon numbers 6–30. x and y are 1–15 independently, respectively, and n is 0–2.

[0009] In a formula (1), R1 and R3 are the alkyl groups or alkenyl radicals of carbon numbers 6–30 according to an individual, respectively. R2 is the alkylene group of carbon numbers 6–30. Since the friction property of a lubricating oil gets worse when the carbon number of R1–R3 exceeds less than 6 and 30, it is not desirable respectively. Furthermore, it is desirable that the carbon numbers of R1–R3 are 10–30 in respect of the reduction effectiveness of a coefficient of static friction, and it is desirable that it is especially 12–24. Moreover, although x and y are the integers of 1–15 independently, respectively, it is a field of the stability as a compound, or corrosive, and it is desirable that it is ten or less, respectively. In addition, it may be independence respectively with x in other repeat units, and x in each repeat unit shown by $[-(S)_x-R^2-]_n$ may differ, respectively, and may be the same again.

[0010] As R1 and R3, specifically For example, a hexyl group, a heptyl radical, An octyl radical, a nonyl radical, a decyl group, an undecyl radical, the dodecyl, a tridecyl radical, A tetradecyl radical, a pentadecyl group, a hexadecyl radical, a heptadecyl radical, An octadecyl radical, a nona decyl group, an icosyl group, a HENIKOSHIRU radical, a DOKOSHIRU radical, A tricosyl group, a tetra-KOSHIRU radical, a pen octopus sill radical, a hexa KOSHIRU radical, Alkyl groups, such as a heptacocyl radical, an octacosyl radical, a nona KOSHIRU radical, and a thoria KONCHIRU radical (the shape of the shape of a straight chain and branching has as these alkyl groups); A hexenyl radical, A heptenyl radical, an octenyl group, a NONENIRU radical, a decenyl radical, an undecenyl radical, A dodecenyl radical, a tridecenyl radical, a tetra-decenyl radical, a PENTA decenyl radical, A hexa decenyl radical, a heptadecenyl radical, an octadecenyl radical, a nona decenyl radical, An icosenyl radical, a HENIKOSENIRU radical, a docosenyl radical, a tricosenyl radical, Alkenyl radical [, such as a tetracosenyl radical, a pen octopus SENIRU radical, a hexacosenyl radical, a heptacosenyl radical, an OKUTAKOSENIRU radical, a nonacosenyl radical, and a

thoria conte nil radical,] (shape of shape of straight chain and branching has as these alkenyl radical, and its location of double bond is also arbitrary); etc. is mentioned. Moreover, an alkyl group or an alkenyl radical has the desirable shape of the point of excelling in a friction property to a straight chain. The field of oxidation stability to an alkyl group is still more desirable.

[0011] As R2, specifically A hexylene radical, a heptylene radical, an octylene radical, A nonylene group, a decylene radical, an undecylene radical, a dodecylene radical, a TORIDESHIREN radical, A tetra-decylene radical, a PENTA decylene radical, a hexa decylene radical, a hepta-decylene radical, An OKUTA decylene radical, a nona decylene radical, an IKOSHIREN radical, a HENIKOSHIREN radical, Alkylene groups (the shape of the shape of a straight chain and branching has as these alkyl groups), such as a DOKOSHIREN radical, a TORIKOSHIREN radical, a tetra-KOSHIREN radical, a pen octopus SHIREN radical, a hexa KOSHIREN radical, a hepta-KOSHIREN radical, an OKUTAKOSHIREN radical, a nona KOSHIREN radical, and a thoria KONCHIREN radical, are mentioned.

[0012] although there is especially no limit as a content of the sulfur in the polysulfide compound of this invention -- the minimum -- 5 mass % -- it is 15 mass % preferably. If there are too few sulphuric contents, the reactivity as a compound will fall, or there is a possibility that an extreme pressure property may fall. moreover, the upper limit -- 70 mass % -- it is 60 mass % preferably. There is a possibility of saying that it will become unstable as a compound if there are too many sulphuric contents, and a problem appears in storage stability, or reactivity is too high and corrosive becomes high. Moreover, in the lubricating oil constituent of this invention, the mixture of two or more sorts of polysulfide compounds with which the structures expressed with a formula (1) differ as a polysulfide compound can also be used.

[0013] By containing the polysulfide compound (henceforth the (A) component) expressed with a formula (1) in the lubricating oil constituent of this invention When a lubricating oil constituent is used for hand control or an automatic transmission, and a tractor or a construction equipment, While holding highly the dynamic friction coefficient (mud) in the synchronizer ring used with hand control or an automatic transmission, and the copper alloy which is the quality of the material of the wet oiling brake used by the tractor or the construction equipment, a coefficient of static friction (microsecond) can be reduced. the lower limit of the content of the (A) component in the lubricating oil constituent of this invention -- constituent whole-quantity criteria -- 0.01 mass % -- desirable -- 0.05 mass % -- it is -- on the other hand -- the upper limit -- constituent whole-quantity criteria -- 10.0 mass % --

it is 5.0 mass % preferably. When the content of the polysulfide compound of this invention does not fulfill 0.01 mass % with constituent whole-quantity criteria, it is deficient in the improvement effect of the extreme pressure property by polysulfide compound combination, and a friction property, and since corrosive [of polysulfide] becomes large too much on the other hand when a content exceeds 10.0 mass % on constituent whole-quantity criteria, it is not desirable respectively.

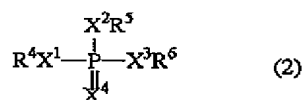
[0014] Moreover, as base oil in the lubricating oil constituent of this invention, the mineral oil and/or synthetic oil of arbitration which are used as base oil of the usual lubricating oil can be used. As mineral oil, oils, normal paraffin, etc., such as paraffin series which refined the lubricating oil fraction obtained by carrying out vacuum distillation of the ordinary pressure residual oil obtained by carrying out atmospheric distillation of the crude oil, combining suitably various purification processings, such as solvent deasphalting, solvent extraction, hydrocracking, solvent dewaxing, contact dewaxing, hydrotreating, sulfuric acid treatment, and clay treatment, etc., and a naphthene, can be used, for example.

[0015] moreover — although there is especially no limit as synthetic oil — the Poly alpha olefin (1-octene oligomer —) The hydrides, such as 1-decene oligomer and an ethylene-propylene oligomer, Isobutene oligomer and its hydride, isoparaffin, alkylbenzene, alkyl naphthalene and diester (a JITORIDESHIRUGU Ruta rate and a JI 2-ethylhexyl horse mackerel peat —) Di-isodecyl adipate, a JITORIDE sill horse mackerel peat, JI 2-ethylhexyl sebacate, etc., a polyol ester (a trimethylol propane KAPURI rate and trimethylolpropane pelargonate —) Pentaerythritol 2-ethylhexanoate, pentaerythritol pelargonate, etc. can use a polyphenyl ether etc. for polyoxy alkylene glycol, dialkyl diphenyl ether, and a list. In addition, although especially the kinematic viscosity of these lubricating oil base oil is not limited but is arbitrary, it is usually desirable for the kinematic viscosity in 100 degrees C to use what is 2–20mm²/s preferably 1–50mm²/s.

[0016] Moreover, the lubricating oil constituent of this invention can contain (B) Lynn system compound further. By using together the Lynn system compound (henceforth the (B) component), the extreme pressure engine performance of a lubricating oil constituent is improved further, and it becomes possible to demonstrate the friction property which was excellent from the first stage. (B) Specifically as a Lynn system compound of a component, the mixture of the phosphoric ester expressed with the following general formula (2), the phosphite expressed with the following general formula (3) and one sort of compounds chosen from the derivatives of these Lynn system compound, or two or more sorts of compounds etc. is mentioned.

[0017]

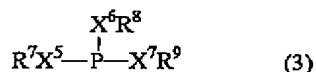
[Formula 7]



R4, R5, and R6 show a hydrogen atom or the hydrocarbon group of carbon numbers 1–30 according to an individual among a formula (2), respectively, and at least one of R4, R5, and R6 is a hydrocarbon group, and X1, X2, X3, and X4 show an oxygen atom or a sulfur atom according to an individual, respectively.

[0018]

[Formula 8]



R7, R8, and R9 show a hydrogen atom or the hydrocarbon group of carbon numbers 1–30 according to an individual among a formula (3), respectively, and at least one of R7, R8, and R9 is a hydrocarbon group, and X5, X6, and X7 show an oxygen atom or a sulfur atom according to an individual, respectively.

[0019] as having mentioned above — R4, R5, R6, R7, R8, and R9 — respectively — an individual exception — a hydrogen atom or the hydrocarbon group of carbon numbers 1–30 — it is — desirable — a hydrogen atom or the hydrocarbon group of carbon numbers 3–30 — a hydrogen atom or the hydrocarbon group of carbon numbers 4–24 is shown more preferably. Here, at least one of R4, R5, and R6 is a hydrocarbon group, and at least one of R7, R8, and R9 is a hydrocarbon group. When the carbon number of the hydrocarbon group of R4, R5, R6, R7, R8, and R9 exceeds 30, since the friction property of a lubricating oil constituent gets worse, it is not desirable.

[0020] As a hydrocarbon group of such carbon numbers 1–30 Specifically For example, a methyl group, an ethyl group, a propyl group, butyl, a pentyl radical, A hexyl group, a heptyl radical, an octyl radical, a nonyl radical, a decyl group, an undecyl radical, The dodecyl, a tridecyl radical, a tetradecyl radical, a pentadecyl group, a hexadecyl radical, A heptadecyl radical, an octadecyl radical, a nona decyl group, an icosyl group, a HENIKOSHIRU radical, A DOKOSHIRU radical, a tricosyl group, a tetra-KOSHIRU radical, a pen octopus sill radical, a hexa KOSHIRU radical, Alkyl groups, such as a heptacocyl radical, an octacosyl radical, a nona KOSHIRU radical, and a thoria KONCHIRU radical (the shape of the shape of a straight chain and branching has as

these alkyl groups); A butenyl group, A pentenyl radical, a hexenyl radical, a heptenyl radical, an octenyl group, a NONENIRU radical, A decenyl radical, an undecenyl radical, a dodecenyl radical, a tridecenyl radical, a tetra-decenyl radical, A PENTA decenyl radical, a hexa decenyl radical, a heptadecenyl radical, an octadecenyl radical, A nona decenyl radical, an icosenyl radical, a HENIKOSENIRU radical, a docosenyl radical, A tricosenyl radical, a tetracosenyl radical, a pen octopus SENIRU radical, a hexacosenyl radical, Alkenyl radicals, such as a heptacosenyl radical, an OKUTAKOSENIRU radical, a nonacosenyl radical, and a thoria conte nil radical (the shape of the shape of a straight chain and branching has as these alkenyl radical) moreover, the location of a double bond is also arbitrary --; cyclopentyl group and a cyclohexyl radical — The cycloalkyl radical of the carbon numbers 5–7, such as a cycloheptyl radical; A methyl cyclopentyl group, A dimethyl cyclopentyl group, a methylethyl cyclopentyl group, a diethyl cyclopentyl group, A methylcyclohexyl radical, a dimethyl cyclohexyl radical, a methylethyl cyclohexyl radical, A diethyl cyclohexyl radical, a methyl cycloheptyl radical, a dimethyl cycloheptyl radical, The alkyl cycloalkyl radical of the carbon numbers 6–11, such as a methylethyl cycloheptyl radical and a diethyl cycloheptyl radical, (the permutation location of an alkyl group is arbitrary); A phenyl group, Aryl groups, such as a naphthyl group : A tolyl group, a xylyl group, an ethyl phenyl group, A propyl phenyl group, a butylphenyl radical, a pentyl phenyl group, a hexyl phenyl group, A heptyl phenyl group, an octyl phenyl group, a nonylphenyl radical, a DESHIRU phenyl group, Each alkyl aryl radical of the carbon numbers 7–18, such as an undecyl phenyl group and a dodecyl phenyl group, (the shape of the shape of a straight chain and branching has as an alkyl group) moreover, the location of a double bond is also arbitrary —; benzyl and a phenylethyl radical — Although each arylated alkyl radical (the shape of the shape of a straight chain and branching has as an alkyl group, and its permutation location of an aryl group is also arbitrary) of the carbon numbers 7–12, such as a phenylpropyl radical, phenyl butyl, a phenyl pentyl radical, and a phenyl hexyl group, etc. is mentioned It is desirable that they are an alkyl group, an alkenyl radical, an aryl group, or an alkyl aryl radical also in these.

[0021] As a derivative of the Lynn system compound, specifically Moreover, for example, a phosphoric acid, In phosphorous acid and said formula (2), in the alkyl acid phosphate one or whose 2 of R4, R5, and R6 are hydrogen, or said formula (3) to the Lynn system compounds, such as acid phosphite one or whose 2 of R7, R8, and R9 are hydrogen Nitrogen-containing compounds, such as an amine compound which contains only ammonia, and the hydrocarbon group or hydroxyl-group content hydrocarbon group of carbon numbers 1–8 in a molecule, are made to act, and the salt

which neutralized a part or all of acid hydrogen that remains is mentioned.

[0022] As this nitrogen-containing compound, specifically For example, ammonia; monomethylamine, A monoethyl amine, a monopropyl amine, a monobutyl amine, mono-pentylamine, Mono-hexylamine, a mono-heptyl amine, a mono-octyl amine, dimethylamine, A methylethyl amine, diethylamine, a methylpropyl amine, ethyl propylamine, A dipropyl amine, a methylbutyl amine, an ethyl butylamine, a propyl butylamine, Dibutyl amine, dipentylamine, a dihexyl amine, diheptylamine, Alkylamines, such as a dioctyl amine (the shape of the shape of a straight chain and branching has as an alkyl group); A mono-methanol amine, Monoethanolamine, mono-propanolamine, a mono-butanol amine, A mono-pentanol amine, a mono-hexanol amine, a mono-heptanol amine, A mono-octanol amine, a mono-nonanol amine, a dimethanol amine, Methanol ethanolamine, diethanolamine, methanol propanolamine, Ethanol propanolamine, dipropanolamine, a methanol butanol amine, An ethanol butanol amine, a propanol butanol amine, dibutanolamine, Alkanolamine [, such as a JIPENTA Norian amine, a JIHEKISA Norian amine, a JIHEPUTA Norian amine and a JIOKUTA Norian amine,] (shape of shape of straight chain and branching has as alkanol radical);, such mixture, etc. are mentioned.

[0023] (B) As a Lynn system compound of a component, the acid phosphite one or whose 2 of R7, R8, and R9 are hydrogen or the amine salt of these Lynn system compound that was mentioned above, an alkanolamine salt, etc. are more preferably used from the point of excelling with a friction property, in the alkyl acid phosphate one or whose 2 of R4, R5, and R6 are hydrogen, or said formula (3) in said formula (2).

[0024] (B) As a desirable compound, especially as a component Specifically Monobutyl phosphate, mono-pentyl phosphate, Mono-hexyl phosphate, MONOPEPU chill phosphate, mono-octyl phosphate, Mono-nonyl phosphate, mono-DESHIRU phosphate, mono-undecyl phosphate, Mono-dodecyl phosphate, mono-tridecyl phosphate, mono-tetradecyl phosphate, Mono-pentadecyl phosphate, mono-hexadecyl phosphate, mono-heptadecyl phosphate, Mono-octadecyl phosphate, mono-nona DESHIRU phosphate, mono-icosyl phosphate, MONOHEN icosyl phosphate, MONODOKO sill phosphate, mono-tricosyl phosphate, Monoalkyl phosphate, such as mono-tetrapod KOSHIRU phosphate (the shape of the shape of a straight chain and branching has as an alkyl group) Moreover, even if it is thio phosphate, it is mono-alkenyl phosphate (the shape of the shape of a straight chain and branching has as an alkenyl radical), such as good; mono-octadecenyl phosphate. Even if the location of a double bond is also arbitrary and it is thio phosphate, good; monophenyl phosphate, Monochrome (alkyl) aryl phosphate, such as mono-cresyl

phosphate (the permutation location of an alkyl group is arbitrary) Even if it is thio phosphate, moreover, good; dibutyl phosphate, dipentyl phosphate, Dihexyl phosphate, JIPEPU chill phosphate, dioctyl phosphate, Dinonyl phosphate, JIDESHIRU phosphate, gin undecyl phosphate, Didodecyl phosphate, JITORIDE sill phosphate, ditetradecyl phosphate, Dipentadecyl phosphate, JIHEKISADE sill phosphate, JIHEPUTADE sill phosphate, Dioctadecyl phosphate, JINONADE sill phosphate, JIIKO sill phosphate, JIHEN icosyl phosphate, JIDOKO sill phosphate, JITORIKO sill phosphate, Dialkyl phosphate, such as JITETORAKO sill phosphate (the shape of the shape of a straight chain and branching has as an alkyl group) Moreover, even if it is thio phosphate, it is dialkenyl phosphate (the shape of the shape of a straight chain and branching has as an alkenyl radical), such as good; JIOKUTA decenyl phosphate. Even if the location of a double bond is also arbitrary and it is thio phosphate, good; diphenyl phosphate, JI (alkyl) aryl phosphate, such as JIKUREJIRU phosphate (the permutation location of an alkyl group is arbitrary) Even if it is thio phosphate, moreover, good; monobutyl phosphite, Mono-pentyl phosphite, mono-hexyl phosphite, MONOPEPU chill phosphite, Mono-octylphosphite, mono-nonyl phosphite, mono-DESHIRU phosphite, Mono-undecyl phosphite, mono-dodecyl phosphite, mono-tridecyl phosphite, Mono-tetradecyl phosphite, mono-pentadecyl phosphite, mono-hexadecyl phosphite, Mono-heptadecyl phosphite, mono-octadecyl phosphite, mono-nona DESHIRU phosphite, Mono-icosyl phosphite, MONOHEN icosyl phosphite, MONODOKO sill phosphite, monoalkyl phosphite (the shape of the shape of a straight chain and branching has as an alkyl group --), such as mono-tricosyl phosphite and mono-tetrapod KOSHIRU phosphite Moreover, even if it is thio phosphite, it is mono-alkenyl phosphite (the shape of the shape of a straight chain and branching has as an alkenyl radical), such as good; mono-octadecenyl phosphite. Even if the location of a double bond is also arbitrary and it is thio phosphite, good; monophenyl phosphite, Monochrome (alkyl) aryl phosphite, such as mono-cresyl phosphite (the permutation location of an alkyl group is arbitrary) Even if it is thio phosphite, moreover, good; dibutyl phosphite, dipentyl phosphite, Dihexyl phosphite, JIPEPU chill phosphite, dioctyl phosphite, Dinonyl phosphite, JIDESHIRU phosphite, gin undecyl phosphite, Didodecyl phosphite, JITORIDE sill phosphite, ditetradecyl phosphite, Dipentadecyl phosphite, JIHEKISADE sill phosphite, JIHEPUTADE sill phosphite, Dioctadecyl phosphite, JINONADE sill phosphite, JIIKO sill phosphite, JIHEN icosyl phosphite, JIDOKO sill phosphite, JITORIKO sill phosphite, Dialkyl phosphite, such as JITETORAKO sill phosphite (the shape of the shape of a straight chain and branching has as an alkyl group) Moreover, even if it is thio phosphite, it is dialkenyl phosphite

(the shape of the shape of a straight chain and branching has as an alkenyl radical), such as good; JIOKUTA decenyl phosphite. Even if the location of a double bond is also arbitrary and it is thio phosphite, good; diphenyl phosphite, JI (alkyl) aryl phosphite, such as JIKUREJIRU phosphite (the permutation location of an alkyl group may be arbitrary, and may be thio phosphite); salt [of these Lynn system compound, and an amine and alkanolamine which were mentioned above];, or such mixture are mentioned.

[0025] The (B) component among R4 and R5 of a formula (2), or R6 In addition, one or two or the inside of R7 and R8 of a formula (3), or R9 — one or two — six or more carbon numbers — desirable — a with a carbon numbers of nine or more alkyl group or an alkenyl radical — more preferably They are straight chain alkyl groups, such as a lauryl radical, the Millis Chill radical, a palmityl radical, a stearyl radical, and an oleyl radical, or a straight chain alkenyl radical. When others are phosphoric ester (thiophosphoric acid ester is sufficient) and phosphite (thio phosphite is sufficient) which are a hydrogen atom, since the improvement effect of the initial concordance nature of a lubricating oil constituent is especially large, it is desirable.

[0026] the case where one kind or two kinds or more of (B) components chosen as arbitration in the lubricating oil constituent of this invention are used together — the lower limit of the content — constituent whole-quantity criteria — as the amount of Lynn elements — 0.005 mass % — desirable — 0.01 mass % — it is — on the other hand — the upper limit — constituent whole-quantity criteria — as the amount of Lynn elements — 0.5 mass % — it is 0.3 mass % preferably. (B) When the content of a component does not fulfill 0.005 mass % with constituent whole-quantity criteria as an amount of Lynn elements (B) when it is deficient in the improvement effectiveness of the extreme pressure property of a lubricating oil constituent and the improvement effect of initial concordance nature by component concomitant use and a content exceeds 0.5 mass % as an amount of Lynn elements on constituent whole-quantity criteria on the other hand Since corrosive [of a lubricating oil constituent] increases and there is a possibility of having a bad influence on endurance, such as a sealant and resin material, it is not desirable respectively.

[0027] Moreover, the lubricating oil constituent of this invention can contain the friction regulator which does not contain (C) Lynn further. Although the lubricating oil constituent containing (A) polysulfide compound concerning this invention has the outstanding friction property and its endurance, it may need high effectiveness with friction properties, such as a cyclo NAIZA ring and a wet oiling brake. In this case, it becomes possible to demonstrate the more excellent friction property by using

together the friction regulator (henceforth the (C) component) which does not contain
 Lynn. (C) Although the compound of arbitration usually used as a friction regulator for
 lubricating oils is usable as a component, what has the alkyl group or alkenyl radical of
 carbon numbers 6-30 in [at least one] a molecule especially is desirable. as an alkyl
 group or an alkenyl radical --- the shape of a straight chain --- the shape of branching
 --- ***** --- a carbon number --- 6-30 --- the compound of 9-24 is preferably
 desirable. Since the friction property of a lubricating oil constituent gets worse when
 the carbon number of an alkyl group or an alkenyl radical exceeds less than 6 and 30,
 it is not desirable respectively.

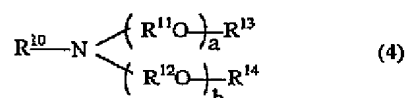
[0028] As this alkyl group or an alkenyl radical, specifically For example, a hexyl group,
 A heptyl radical, an octyl radical, a nonyl radical, a decyl group, an undecyl radical, the
 dodecyl, A tridecyl radical, a tetradecyl radical, a pentadecyl group, a hexadecyl
 radical, A heptadecyl radical, an octadecyl radical, a nona decyl group, an icosyl group,
 a HENIKOSHIRU radical, A DOKOSHIRU radical, a tricosyl group, a tetra-KOSHIRU
 radical, a pen octopus sill radical, a hexa KOSHIRU radical, Alkyl groups, such as a
 heptacocyl radical, an octacosyl radical, a nona KOSHIRU radical, and a thoria
 KONCHIRU radical (the shape of the shape of a straight chain and branching has as
 these alkyl groups); A hexenyl radical, A heptenyl radical, an octenyl group, a
 NONENIRU radical, a decenyl radical, an undecenyl radical, A dodecenyl radical, a
 tridecenyl radical, a tetra-decenyl radical, a PENTA decenyl radical, A hexa decenyl
 radical, a heptadecenyl radical, an octadecenyl radical, a nona decenyl radical, An
 icosenyl radical, a HENIKOSENIRU radical, a docosenyl radical, a tricosenyl radical,
 Alkenyl radical [, such as a tetracosenyl radical, a pen octopus SENIRU radical, a
 hexacosenyl radical, a heptacosenyl radical, an OKUTAKOSENIRU radical, a
 nonacosenyl radical, and a thoria conte nil radical,] (shape of shape of straight chain
 and branching has as these alkenyl radicals, and its location of double bond is also
 arbitrary); etc. is mentioned.

[0029] (C) The amine compound which specifically has the alkyl group or alkenyl
 radical of carbon numbers (C-1) 6-30 in [at least one] a molecule as a friction
 regulator of a component, Or the ester of the fatty acid which has the alkyl group or
 alkenyl radical of the derivative and carbon numbers (C-2) 6-30 in [at least one] a
 molecule, One sort or two sorts or more of compounds chosen from the sulfides of an
 amide, imide or a metal salt, and unsaturated fatty acid ester are mentioned as a
 desirable compound. being mentioned here (C-1) --- the aliphatic series monoamine
 expressed with the more concrete for example, following general formula (4) as an
 amine compound or its alkylene oxide addition product, the aliphatic series polyamine

expressed with the following general formula (5), the imidazoline compound expressed with a general formula (6) are mentioned.

[0030]

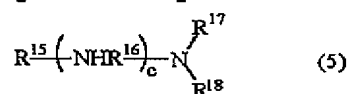
[Formula 9]



The alkyl group or alkenyl radical of 9-24 is shown preferably. the inside of a formula (4), and R10 --- carbon numbers 6-30 --- R11 and R12 show ethylene or a propylene radical according to an individual, respectively. R13 </SUP> and R14 --- respectively --- an individual exception --- hydrogen or the hydrocarbon group of carbon numbers 1-30 --- being shown --- a and b --- respectively --- an individual exception --- 0-10 --- desirable --- the integer of 0-6 --- being shown --- a+b=0-10 [and] --- it is 0-6 preferably.

[0031]

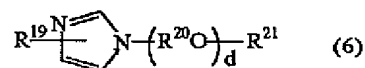
[Formula 10]



the inside of a formula (5), and R15 --- carbon numbers 6-30 --- desirable --- the alkyl group or alkenyl radical of 9-24 --- being shown --- R16 --- ethylene or a propylene radical --- being shown --- R17 and R18 --- respectively --- an individual exception --- hydrogen or the hydrocarbon group of carbon numbers 1-30 --- being shown --- c --- 1-5 --- the integer of 1-4 is shown preferably.

[0032]

[Formula 11]



the inside of a formula (6), and R19 --- carbon numbers 6-30 --- desirable --- the alkyl group or alkenyl radical of 9-24 --- being shown --- R20 --- ethylene or a propylene radical --- being shown --- R21 --- hydrogen or the hydrocarbon group of carbon numbers 1-30 --- being shown --- d --- 0-10 --- the integer of 0-6 is shown preferably.

[0033] in addition --- although the shape of the shape of a straight chain and branching has as the alkyl group which shows R10, R15, and R19, or an alkenyl radical --- the

carbon number — 6–30 — 9–24 are preferably desirable. Since the friction property of a lubricating oil constituent gets worse when exceeding the case where the carbon number of an alkyl group or an alkenyl radical is less than six, and 30, it is not desirable respectively. Although various kinds of alkyl groups, alkenyl radicals, etc. which were specifically mentioned above are mentioned as the alkyl group which shows R10, R15, and R19, or an alkenyl radical, especially the straight chain alkyl group or alkenyl radicals of carbon numbers 12–18, such as a lauryl radical from the point that a friction property is more excellent, the Millis Chill radical, a palmityl radical, a stearyl radical, and an oleyl radical, are desirable.

[0034] moreover, as a radical which shows R13, R14, R17, R18, and R21 Specifically A hydrogen; methyl group, an ethyl group, a propyl group, butyl, a pentyl radical, A hexyl group, a heptyl radical, an octyl radical, a nonyl radical, a decyl group, an undecyl radical, The dodecyl, a tridecyl radical, a tetradecyl radical, a pentadecyl group, a hexadecyl radical, A heptadecyl radical, an octadecyl radical, a nona decyl group, an icosyl group, a HENIKOSHIRU radical, A DOKOSHIRU radical, a tricosyl group, a tetra-KOSHIRU radical, a pen octopus sill radical, a hexa KOSHIRU radical, Alkyl groups, such as a heptacosyl radical, an octacosyl radical, a nona KOSHIRU radical, and a thoria KONCHIRU radical (the shape of the shape of a straight chain and branching has as these alkyl groups); A butenyl group, A pentenyl radical, a hexenyl radical, a heptenyl radical, an octenyl group, a NONENIRU radical, A decenyl radical, an undecenyl radical, a dodecenyl radical, a tridecenyl radical, a tetra-decenyl radical, A PENTA decenyl radical, a hexa decenyl radical, a heptadecenyl radical, an octadecenyl radical, A nona decenyl radical, an icosenyl radical, a HENIKOSENIRU radical, a docosenyl radical, A tricosenyl radical, a tetracosenyl radical, a pen octopus SENIRU radical, a hexacosenyl radical, Alkenyl radicals, such as a heptacosenyl radical, an OKUTAKOSENIRU radical, a nonacosenyl radical, and a thoria conte nil radical (the shape of the shape of a straight chain and branching has as these alkenyl radicals) moreover, the location of a double bond is also arbitrary —; cyclopentyl group and a cyclohexyl radical — The cycloalkyl radical of the carbon numbers 5–7, such as a cycloheptyl radical; A methyl cyclopentyl group, A dimethyl cyclopentyl group, a methylethyl cyclopentyl group, a diethyl cyclopentyl group, A methylcyclohexyl radical, a dimethyl cyclohexyl radical, a methylethyl cyclohexyl radical, A diethyl cyclohexyl radical, a methyl cycloheptyl radical, a dimethyl cycloheptyl radical, The alkyl cycloalkyl radical of the carbon numbers 6–11, such as a methylethyl cycloheptyl radical and a diethyl cycloheptyl radical; A phenyl group, Aryl groups, such as a naphthyl group : A tolyl group, a xylyl group, an ethyl phenyl group, A

propyl phenyl group, a buthylphenyl radical, a pentyl phenyl group, a hexyl phenyl group, A heptyl phenyl group, an octyl phenyl group, a nonylphenyl radical, a DESHIRU phenyl group, Each alkyl aryl radical of the carbon numbers 7-18, such as an undecyl phenyl group and a dodecyl phenyl group, (the shape of the shape of a straight chain and branching has as an alkyl group) moreover, a permutation location is also arbitrary --; benzyl, a phenylethyl radical, and a phenylpropyl radical -- Each arylated alkyl radical [of the carbon numbers 7-12, such as phenyl butyl, a phenyl pentyl radical and a phenyl hexyl group,] (shape of shape of straight chain and branching has as alkyl group, and its permutation location is also arbitrary); etc. is mentioned.

[0035] As the aliphatic series monoamine expressed with said formula (4), or its alkylene oxide addition product In the formula (4) from a point which is excellent with a friction property R13 and R14 The aliphatic series monoamine which is hydrogen or the alkyl group of carbon numbers 1-6 separately, and is $a=b=0$, The alkylene oxide addition product of the aliphatic series monoamine which R13 and R14 are hydrogen, and a and b are 0-6 separately, and is a number used as $a+b=1-6$ is used more preferably. Moreover, as aliphatic series polyamine expressed with said formula (5), the aliphatic series polyamine R17 and whose R18 are hydrogen or the alkyl group of carbon numbers 1-6 separately is more preferably used in a formula (5) from the point of excelling with a friction property. Moreover, as an imidazoline compound expressed with said formula (6), the imidazoline compound whose R21 is hydrogen or the alkyl group of carbon numbers 1-6 is more preferably used in a formula (6) from the point of excelling with a friction property.

[0036] On the other hand as a derivative of the amine compound as used in the field of (C-1) To an amine compound like said formula (4) - (6), for example, the monocarboxylic acid (fatty acid etc.) of carbon numbers 2-30, The polycarboxylic acid of the carbon numbers 2-30 of oxalic acid, a phthalic acid, trimellitic acid, pyromellitic acid, etc. is made to act. Neutralize a part or all of the amino group which remains, and/or an imino group, or The amidated so-called acid denaturation compound; A boric acid is made to act on an amine compound like formula (4) - (6). The so-called boric-acid denaturation compound which neutralized a part or all of the amino group which remains, and/or an imino group; to a formula (4) or an amine compound as shown in (6) The so-called alkylene oxide addition product of the amine compound to which alkylene oxide, such as ethylene oxide and propylene oxide, was made to react; denaturation object [of the amine compound obtained combining two or more sorts of denaturation chosen from these]; etc. is mentioned.

[0037] As the amine compound of (C-1), or its derivative The lauryl amine from the

point of specifically excelling in a friction property, lauryl diethylamine, Lauryl diethanolamine, dodecyl dipropanolamine, palmitylamine, A stearyl amine, stearyl tetraethylenepentamine, an oleyl amine, Oleyl propylenediamine, oleyl diethanolamine, amine compound [, such as N-hydroxyethyl oleyl imidazoline,]; — alkylene oxide addition product [of these amines compound]; — alkylene oxide addition product [of these amines compound]; or such mixture are used especially preferably.

[0038] although straight-chain fatty acid or branched-chain fatty acid is sufficient and saturated fatty acid or unsaturated fatty acid is sufficient as a fatty acid in the fatty acid ester, the fatty-acid amide, the fatty-acid imide, or the fatty-acid metal salt of the above (C-2) — the carbon number of the alkyl group or an alkenyl radical — 6-30 — 9-24 are preferably desirable. And the same is said of the hydrocarbon group of the sulfide of unsaturated fatty acid ester. Since the friction property of a wet clutch gets worse when exceeding the case where the carbon number of the alkyl group of a fatty acid or an alkenyl radical is less than six, and 30, it is not desirable respectively.

[0039] As this fatty acid, specifically Oenanthic acid, an octanoic acid, nonoic acid, A decanoic acid, undecanoic acid, dodecanoic acid, a tridecane acid, a tetradecanoic acid, A pentadecane acid, hexadecanoic acid, a heptadecanoic acid, octadecanoic acid, A nonadecane acid, icosanoic acid, a henicosane acid, docosanoic acid, a tricosane acid, A tetracosanoic acid, a pentacosane acid, a hexacosane acid, a heptacosane acid, Saturated fatty acid, such as octacosanoic acid, a nonacosane acid, and a triacontanoic acid (the shape of the shape of a straight chain and branching has as saturated fatty acid); A heptene acid, Octenate, a nonene acid, a decene acid, an undecene acid, a dodecen acid, tridecenoic acid, A tetra-decene acid, pentadecene acid, a hexa decene acid, heptadecenoic acid, An octadecene acid, a nonadecen acid, an IKOSEN acid, a HENIKOSEN acid, the decosenoic acid, A TORIKOSEN acid, a tetrachocenic acid, a pen TAKOSEN acid, a hexa KOSEN acid, Although unsaturated fatty acid (the shape of the shape of a straight chain and branching has as unsaturated fatty acid, and its location of a double bond is also arbitrary), such as a hepta-KOSEN acid, an OKUTAKOSEN acid, a nona KOSEN acid, and a thoria KONTEN acid, alkenyl succinic-acid [with the still more nearly same alkenyl radical];, etc. are mentioned The mixture of the straight-chain fatty acid compounded from the point of excelling especially with a friction property, with straight-chain fatty acid, an oxo process, etc. of a lauric acid, a myristic acid, a palmitic acid, stearin acid, oleic acid, and the straight-chain fatty acid (palm oil fatty acid etc.) guided from various fats and oils, and branched-chain fatty acid is used preferably.

[0040] Specifically as fatty acid ester as used in the field of (C-2), the

polyhydric-alcohol ester of said fatty acid etc. is mentioned. As this polyhydric alcohol, the polyhydric alcohol of carbon numbers 3-6 or its dimer, and a trimer are mentioned, and, specifically, polyhydric alcohol, such as a glycerol, trimethylolethane, trimethylol propane, pentaerythritol, and sorbitan, and the diglycerol of those which is 2 - a trimer, ditrimethylol ethane, a ditrimethylol propane, dipentaerythritol, triglycerol, TORITORI methylol ethane, a TORITORI methylol propane, tripentaerythritol, etc. are mentioned. In addition, it is desirable [0041] to use partial ester from the point of excelling with a friction property, in this invention, although the so-called partial ester which remains while it has been the form of a hydroxyl group where all the hydroxyl groups in polyhydric alcohol were esterified and where the so-called full ester is sufficient, and at least one or more of the hydroxyl group in polyhydric alcohol are not esterified is sufficient as ester here. As a compound desirable as fatty acid ester Specifically Glycerine monolaurate, glycerol monochrome iso laurate, A glycerol JIRAU rate, glycerol JIISO laurate, a glycerol mono-millimeter state, A glycerol MONOISO millimeter state, the glycerol JIMIRI State, a glycerol JIISO millimeter state, Glycerol monopalmitate, glycerol monochrome iso palmitate, glycerol dipalmitate, Glycerol JIISO palmitate, glycerol monostearate, glycerin monoisostearate, Glycerol distearate, glycerinediisostearate, glycerol monooleate, Glycerol partial ester, such as glycerol monochrome iso oleate, glycerol dioleate, and glycerol JIISO oleate; Trimethylolethane mono-laurate, Trimethylolethane monochrome iso laurate, the trimethylolethane JIRAU rate, Trimethylolethane JIISO laurate, a trimethylolethane mono-millimeter state, The trimethylolethane MONOISO millimeter state, the trimethylolethane JIMIRI State, The trimethylolethane JIISO millimeter state, trimethylolethane monopalmitate, Trimethylolethane monochrome iso palmitate, trimethylolethane dipalmitate, Trimethylolethane JIISO palmitate, trimethylolethane monostearate, Trimethylolethane monoisostearate, trimethylolethane distearate, Trimethylolethane diisostearate, trimethylolethane monooleate, Trimethylolethane monochrome iso oleate, trimethylolethane dioleate, Trimethylolethane partial ester, such as trimethylolethane JIISO oleate; Trimethylol propane mono-laurate, Trimethylol propane monochrome iso laurate, a trimethylol propane JIRAU rate, Trimethylol propane JIISO laurate, a trimethylol propane mono-millimeter state, A trimethylol propane MONOISO millimeter state, the trimethylol propane JIMIRI State, A trimethylol propane JIISO millimeter state, trimethylol propane monopalmitate, Trimethylol propane monochrome iso palmitate, trimethylol propane dipalmitate, Trimethylol propane JIISO palmitate, trimethylol propane monostearate, Trimethylol propane monoisostearate, trimethylol propane distearate, Trimethylol propane

diisostearate, trimethylol propane monooleate, Trimethylol propane monochrome iso oleate, trimethylol propane dioleate, Trimethylol propane partial ester, such as trimethylol propane JIISO oleate; Pentaerythritol mono-laurate, Pentaerythritol monochrome iso laurate, a pentaerythritol JIRAU rate, Pentaerythritol JIISO laurate, pentaerythritol trilaurate, Pentaerythritol TORIISO laurate, a pentaerythritol mono-millimeter state, A pentaerythritol MONOISO millimeter state, a pentaerythritol JIMIRI state, A pentaerythritol JIISO millimeter state, the pentaerythritol TORIMIRI State, A pentaerythritol TORIISO millimeter state, pentaerythritol monopalmitate, Pentaerythritol monochrome iso palmitate, pentaerythritol dipalmitate, Pentaerythritol JIISO palmitate, pentaerythritol tripalmitate, Pentaerythritol TORIISO palmitate, pentaerythritol monostearate, Pentaerythritol monoisostearate, pentaerythritol distearate, Pentaerythritol diisostearate, pentaerythritol tristearate, Pentaerythritol TORIISO stearate, pentaerythritol monooleate, Pentaerythritol monochrome iso oleate, pentaerythritol dioleate, Pentaerythritol JIISO oleate, pentaerythritol trio REETO, Pentaerythritol partial ester, such as pentaerythritol TORIISO oleate; Sorbitan monolaurate, Sorbitan monochrome iso laurate, a sorbitan JIRAU rate, sorbitan JIISO laurate, Sorbitan trilaurate, sorbitan TORIISO laurate, a sorbitan mono-millimeter state, A sorbitan MONOISO millimeter state, the sorbitan JIMIRI State, a sorbitan JIISO millimeter state, The sorbitan TORIMIRI State, a sorbitan TORIISO millimeter state, sorbitan monopalmitate, Sorbitan monochrome iso palmitate, sorbitan dipalmitate, sorbitan JIISO palmitate, sorbitan tripalmitate, sorbitan TORIISO palmitate, sorbitan monostearate, sorbitan monoisostearate, sorbitan JISUTEARE Sorbitan partial ester [, such as - TO, sorbitan diisostearate, sorbitan tristearate, sorbitan TORIISO stearate, sorbitan monooleate, sorbitan monochrome iso oleate, sorbitan dioleate, sorbitan JIISO oleate, sorbitan trioleate, and sorbitan TORIISO oleate,],, such mixture, etc. can be illustrated.

[0042] From the point of excelling especially in a friction property to furthermore, glycerol monooleate Glycerol dioleate, trimethylolethane monooleate, trimethylolethane dioleate, Trimethylol propane monooleate, trimethylol propane dioleate, Pentaerythritol monooleate, pentaerythritol dioleate, Pentaerythritol trio REETO, sorbitan monooleate, Sorbitan dioleate, sorbitan trioleate, such mixture, etc. are used more preferably. The glycerol monooleate which is furthermore monooleate, trimethylolethane monooleate, trimethylol propane monooleate, pentaerythritol monooleate, sorbitan monooleate, such mixture, etc. are used most preferably. Moreover, an amide or imide etc. which nitrogen-containing compounds, such as an amine compound which contains only ammonia, and the hydrocarbon group or

hydroxyl-group content hydrocarbon group of carbon numbers 1-8 for said fatty acid, an alkenyl succinic-acid anhydride, or its acid chloride in a molecule, are made to specifically react as a fatty-acid amide as used in the field of (C-2), and is obtained is mentioned.

[0043] As this nitrogen-containing compound, specifically Ammonia; monomethylamine, A monoethyl amine, a monopropyl amine, a monobutyl amine, mono-pentylamine, Mono-hexylamine, a mono-heptyl amine, a mono-octyl amine, dimethylamine, A methylethyl amine, diethylamine, a methylpropyl amine, ethyl propylamine, A dipropyl amine, a methylbutyl amine, an ethyl butylamine, a propyl butylamine, Dibutyl amine, dipentylamine, a dihexyl amine, diheptylamine, Alkylamines, such as a dioctyl amine (the shape of the shape of a straight chain and branching has as an alkyl group); A mono-methanol amine, Monoethanolamine, mono-propanolamine, a mono-butanol amine, A mono-pentanol amine, a mono-hexanol amine, a mono-heptanol amine, A mono-octanol amine, a mono-nonanol amine, a dimethanol amine, Methanol ethanolamine, diethanolamine, methanol propanolamine, Ethanol propanolamine, dipropanolamine, a methanol butanol amine, An ethanol butanol amine, a propanol butanol amine, dibutanolamine, Alkanolamine [, such as a JIPENTA Norian amine, a JIHEKISA Norian amine, a JIHEPUTA Norian amine and a JIOKUTA Norian amine,] (shape of shape of straight chain and branching has as alkanol radical);, such mixture, etc. are mentioned.

[0044] As a fatty-acid amide of (C-2), specifically The lauric-acid amide from the point of excelling with a friction property, lauric-acid diethanolamide, A lauric-acid mono-propanol amide, a myristic-acid amide, myristic-acid diethanolamide, A myristic-acid mono-propanol amide, a palmitic-acid amide, palmitic-acid diethanolamide, A palmitic-acid mono-propanol amide, octadecanamide, stearin acid diethanolamide, A stearin acid mono-propanol amide, oleic amide, oleic acid diethanolamide, An oleic acid mono-propanol amide, a palm-oil-fatty-acid amide, palm-oil-fatty-acid diethanolamide, A palm-oil-fatty-acid mono-propanol amide, the synthetic mixing fatty-acid amide of carbon numbers 12-13, the synthetic mixing fatty-acid diethanolamide of carbon numbers 12-13, the synthetic mixing fatty-acid mono-propanol amides of carbon numbers 12-13, such mixture, etc. are used especially preferably.

[0045] On the other hand, as a fatty-acid metal salt as used in the field of (C-2), alkaline-earth-metal salts (the magnesium salt, calcium salt, etc.), zinc salt, etc. of said fatty acid are specifically mentioned. Specifically as a fatty-acid metal salt of (C-2), lauric-acid calcium, myristic-acid calcium, palmitic-acid calcium, calcium

stearate, oleic acid calcium, palm-oil-fatty-acid calcium, the synthetic mixing fatty-acid calcium of carbon numbers 12-13, lauric-acid zinc, myristic-acid zinc, palmitic-acid zinc, zinc stearate, zinc oleate, palm-oil-fatty-acid zinc, the synthetic mixing fatty-acid zinc of carbon numbers 12-13, such mixture, etc. are especially used preferably from the point of excelling with the friction property of a wet clutch. As a sulfide of the unsaturated fatty acid ester as used in the field of furthermore (C-2), the reactant of said unsaturated fatty acid ester and sulfur is mentioned, for example. As a sulfide of the unsaturated fatty acid ester of (C-2), the sulfide of oleic acid methyl ester is especially used preferably from the point of excelling with a synchro property or the friction property of a brake. Moreover, the mixture which consists of a mixed rate of the arbitration of the compound of two or more sorts chosen as a (C) component (C-1) (C-2) needless to say from friction regulators which are represented of different structures can also be used.

[0046] the case where one kind or two kinds or more of (C) components chosen as arbitration in the lubricating oil constituent of this invention are used together -- the lower limit of the content -- constituent whole-quantity criteria -- 0.01 mass % -- desirable -- 0.03 mass % -- it is -- on the other hand -- the upper limit -- constituent whole-quantity criteria -- 5.0 mass % -- it is 3.0 mass % preferably. (C) When the content of a component does not fulfill 0.01 mass % with constituent whole-quantity criteria, it is deficient in the improvement effect over the friction property by (C) component concomitant use, and since a coefficient of static friction (microsecond) falls too much and effectiveness of a wet oiling brake falls on the other hand when a content exceeds 5.0 mass % on constituent whole-quantity criteria, it is not desirable respectively.

[0047] When using the amine compound of (C-1) as a (C) component in this invention, here As a (B) component mentioned above, among R4 and R5 of a formula (2), or R6, one or two Among R7 and R8 of a formula (3), or R9, or one or two the phosphoric ester (thiophosphoric acid ester is sufficient) whose others it is the hydrocarbon group of carbon numbers 1-30, and are hydrogen atoms, and phosphite (thio phosphite is sufficient) -- when especially phosphite is used together, especially the improvement effect of the initial concordance nature of a lubricating oil constituent is large. In this case, the above-mentioned phosphoric ester or phosphite of the amine compound of a component (C-1) and the (B) component may be added to lubricating oil base oil in the form of the salt of the amine compound to which add to lubricating oil base oil independently, respectively, and both were made to react beforehand, and phosphorus compounds.

[0048] Moreover, the lubricating oil constituent of this invention can contain (D) basicity metal system detergent. This basic metal system detergent (henceforth the (D) component) is effective in making hand control or the synchro property and tractor of an automatic transmission, a high dynamic friction coefficient (mud) required for brake-noise prevention of a construction equipment, and a low coefficient of static friction (microsecond) appear. Although (A) polysulfide compound concerning this invention has the effectiveness of maintaining a dynamic friction coefficient (mud) and reducing a coefficient of static friction (microsecond) even if it uses it independently, the effectiveness increases by using together with the (D) component. (D) The lower limits of the total basicity of the basic metal system detergent of a component are 100 mgKOH/g preferably 50 mgKOH/g, and, on the other hand, the upper limit is 450 mgKOH/g. Since the oxidation stability of a lubricating oil constituent gets worse when the total basicity is less than 50 mgKOH/g, and there is a possibility of having a bad influence on the storage stability of a lubricating oil constituent, on the other hand when the total basicity exceeds 450 mgKOH/g, it is not desirable respectively. In addition, the total basicity said here is JIS. The total basicity by the perchloric acid method measured based on 7. of K2501 "the petroleum product and lubricating oil-neutralization value examining method" is meant.

[0049] (D) As an example of a component, one kind or two kinds or more of basic metal system detergent with which the basic alkaline-earth-metal sulfonate of 50 – 450 mgKOH/g is chosen for the total basicity, and the basic alkali earth metal phenate of 50 – 450 mgKOH/g and the total basicity (D-3) are chosen for the total basicity (D-2) from basic alkaline-earth-metal SARISHI rate **s of 50 – 450 mgKOH/g, for example (D-1) is mentioned. As alkaline-earth-metal sulfonate, the alkaline-earth-metal salt especially the magnesium salt, and/or the calcium salt of molecular weight 100–1500 and the alkyl aromatic series sulfonic acid obtained by sulfonating the alkyl aromatic compound of 200–700 preferably are used preferably, and the so-called petroleum sulfonic acid, synthetic sulfonic acid, etc. are more specifically mentioned specifically as alkyl aromatic series sulfonic acid.

[0050] As petroleum sulfonic acid, the so-called mahogany acid which carries out a byproduction is used at the time of what generally sulfonated the alkyl aromatic compound of the lubricating oil fraction of mineral oil, or White oil manufacture. Moreover, alkylbenzene which has the alkyl group of the shape of the shape of a straight chain acquired by carrying out a byproduction as synthetic sulfonic acid from the alkylbenzene manufacturing plant which serves as a raw material of a detergent, for example, or alkylating polyolefine with benzene, or branching is used as a raw

material, and the thing which sulfonated this, or the thing which sulfonated dinonyl naphthalene is used. Moreover, although there is especially no limit as a sulfonation agent at the time of sulfonating these alkyl aromatic compound, an oleum and a sulfuric acid are usually used. Moreover, as alkali earth metal phenate, the alkaline-earth-metal salt especially the magnesium salt, and/or the calcium salt of a Mannich reaction product of the alkylphenol which carbon numbers 4-30, the alkylphenol which has at least one alkyl group of the shape of the shape of a straight chain of 6-18 and branching preferably, the alkylphenol sulfide which this alkylphenol and elementary sulfur are made to react and is obtained, or this alkylphenol and formaldehyde are made to react, and is obtained are more specifically used preferably. [0051] Moreover, as an alkaline-earth-metal SARISHI rate, carbon numbers 4-30, the alkaline-earth-metal salt of the alkyl salicylic acid which has at least one alkyl group of the shape of the shape of a straight chain of 6-18 and branching preferably especially magnesium salt, and/or a calcium salt are more specifically used preferably. (D-1) To basic alkaline-earth-metal sulfonate, basic (D-2) alkali earth metal phenate, and (D-3) a basic alkaline-earth-metal SARISHI rate As long as the total basicity is in the range of 50 - 450 mgKOH/g Alkyl aromatic series sulfonic acid, alkylphenol, alkylphenol sulfide, The Mannich reaction product of alkylphenol, an alkyl salicylic acid, etc. Make it react directly with alkaline-earth-metal bases, such as an oxide of the alkaline earth metal of magnesium and/or calcium, and a hydroxide, or Or by making it permute by the alkaline-earth-metal salt, once it considers as alkali-metal salts, such as sodium salt and potassium salt, etc. The basic salt obtained by heating a superfluous alkaline-earth-metal salt and an alkaline-earth-metal base (the hydroxide and oxide of alkaline earth metal) for the neutral salt (normal salt) obtained under existence of water, The fault basic salt (ultrabasic salt) obtained by making neutral salt (normal salt) react with the base of alkaline earth metal under existence of carbon dioxide gas is contained. In addition, these reactions are usually performed in solvents (aromatic hydrocarbon solvents, such as aliphatic hydrocarbon solvents, such as a hexane, and a xylene, light lubricating oil base oil, etc.). Moreover, although metal system detergent is usually marketed in the condition of having diluted with light lubricating oil base oil etc. and is available, generally it is desirable 1.0 to 20 mass % and for the metal content to use the thing of 2.0 - 16 mass % preferably.

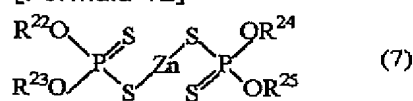
[0052] the case where one kind or two kinds or more of (D) components chosen as arbitration in the lubricating oil constituent of this invention are used together --- the lower limit of the content --- constituent whole-quantity criteria --- 0.05 mass % --- desirable --- 0.1 mass % --- it is --- on the other hand --- the upper limit --- constituent

whole-quantity criteria — 5.0 mass % — it is 3.0 mass % preferably. (D) When the content of a component does not fulfill 0.05 mass % with constituent whole-quantity criteria, it is deficient in the improvement effectiveness of the friction property of the lubricating oil constituent by (D) component concomitant use, and since the oxidation stability of a lubricating oil constituent falls and there is a possibility of starting the blinding of friction material, on the other hand when a content exceeds 5.0 mass % on constituent whole-quantity criteria, it is not desirable respectively.

[0053] Moreover, the lubricating oil constituent of this invention can contain (E) thiophosphoric acid zinc further. That effectiveness is large, when it is effective in reducing a coefficient of static friction (microsecond) and uses together with (D) basicity metal system detergent especially at the same time this thiophosphoric acid zinc (henceforth the (E) component) raises oxidation stability. Moreover, the effectiveness that the (E) component reduces a coefficient of static friction (microsecond) is remarkable in the hand control which used the copper alloy or the synchronizer ring and tractor of an automatic transmission, and the wet oiling brake of a construction equipment, and the brake noise in the connection and the tractor in hand control or an automatic transmission, or a construction equipment can be prevented more effectively. (E) Specifically as thiophosphoric acid zinc of a component, the dithiophosphate zinc expressed with the following general formula (7) is mentioned.

[0054]

[Formula 12]



R22, R23, R24, and R25 show the alkyl group of carbon numbers 1–18, an aryl group, or the alkyl aryl radical of carbon numbers 7–18 according to an individual among a formula (7), respectively.

[0055] As an alkyl group, a methyl group, an ethyl group, a propyl group, butyl, a pentyl radical, a hexyl group, a heptyl radical, an octyl radical, a nonyl radical, a decyl group, an undecyl radical, the dodecyl, a tridecyl radical, a tetradecyl radical, a pentadecyl group, a hexadecyl radical, a heptadecyl radical, an octadecyl radical, etc. are specifically mentioned, and especially the alkyl group of carbon numbers 3–8 is desirable. The shape of the shape of a straight chain and branching has as these alkyl groups. The 1st class (primary) alkyl group or the 2nd class (secondary) alkyl group is sufficient as these again.

[0056] Although mixture of an alpha olefin may be used as a raw material in case R22, R23, R24, and R25 are introduced, it becomes the mixture of the dialkyl phosphorodithioate zinc which has the alkyl group of different structure as a compound expressed with a formula (7) in this case. Specifically as an aryl group, a phenyl group, a naphthyl group, etc. are mentioned. Specifically as an alkyl aryl radical, a tolyl group, a xylyl group, an ethyl phenyl group, a propyl phenyl group, a butylphenyl radical, a pentyl phenyl group, a hexyl phenyl group, a heptyl phenyl group, an octyl phenyl group, a nonylphenyl radical, a DESHIRU phenyl group, an undecyl phenyl group, a dodecyl phenyl group, etc. are mentioned (the shape of the shape of a straight chain and branching has as these alkyl groups, and they include all substitution isomer objects).

[0057] As R22, R23, R24, and R25 Any of such an alkyl group, an aryl group, and an alkyl aryl radical are sufficient. The dithiophosphate zinc which has the 2nd class alkyl group as a (E) component when an extreme pressure property is required of a lubricating oil constituent When thermal resistance is required, it is desirable to use the dithiophosphate zinc which has an aryl group or an alkyl aryl radical as a (E) component, but when the improvement effect of a friction property etc. is taken into consideration, it is most desirable to use the dithiophosphate zinc which has the 1st class alkyl group synthetically. Furthermore, especially the dithiophosphate zinc that has the 1st class alkyl group of basicity shows the outstanding oxidation stability, and its concomitant use with the dithiophosphate zinc of independent or others is effective.

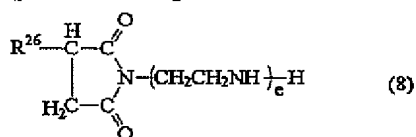
[0058] the case where one kind or two kinds or more of (E) components chosen as arbitration in the lubricating oil constituent of this invention are used together -- the lower limit of the content -- constituent whole-quantity criteria -- 0.05 mass % -- desirable -- 0.1 mass % -- it is -- on the other hand -- the upper limit -- constituent whole-quantity criteria -- 5.0 mass % -- it is 3.0 mass % preferably. (E) When the content of a component does not fulfill 0.05 mass % with constituent whole-quantity criteria, it is deficient in the reduction effectiveness of the coefficient of static friction (microsecond) of the lubricating oil constituent by (E) component concomitant use, and since there is a possibility of there being a possibility of starting the blinding of friction material, and having a bad influence on endurance, such as a sealant and resin material, on the other hand when a content exceeds 5.0 mass % on constituent whole-quantity criteria, it is not desirable respectively.

[0059] Moreover, the lubricating oil constituent of this invention can contain (F) succinimid system ash-free dispersant. Improvement in the oxidation stability of a

constituent and thermal stability is expectable by using together a succinimid system ash-free dispersant (henceforth the (F) component). Moreover, it has the effectiveness of raising the dynamic friction coefficient between the synchronizer ring at the time of gear change actuation, and a gear cone, and in system ** of a wet oiling brake (mud). (F) As a component being concrete, the succinimid which has the alkyl group or alkenyl radical of carbon numbers 30-300 in [at least one] a molecule, or its derivative is mentioned, for example, and one kind chosen as arbitration from these or two kinds or more can be blended. (F) The compound more specifically shown by the following general formula (8) or (9) as a component is mentioned.

[0060]

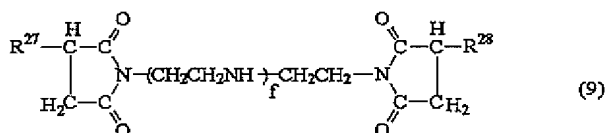
[Formula 13]



the inside of a formula (8), and R²⁶ --- carbon numbers 30-300 --- desirable --- the alkyl group or alkenyl radical of 40-150 --- being shown --- e --- 1-5 --- the integer of 2-4 is shown preferably.

[0061]

[Formula 14]



the inside of a formula (9), and R²⁷ and R²⁸ --- respectively --- an individual exception --- carbon numbers 30-300 --- desirable --- the alkyl group or alkenyl radical of 40-150 --- being shown --- f --- 0-4 --- the integer of 1-3 is shown preferably.

[0062] In addition, although there are so-called succinimid of a monotype like the general formula (8) which the succinic anhydride added to the end of polyamine, and the so-called bis-type like the general formula (2) which the succinic anhydride added to the both ends of polyamine of succinimid on the occasion of imide-izing, as a (F) component, the either is [such mixture] usable [succinimid]. As this alkyl group or an alkenyl radical, although the shape of the shape of a straight chain and branching has, specifically as a desirable thing, a branching-like alkyl group, a branching-like alkenyl radical, etc. which are guided from the oligomer of olefins, such as a propylene, 1-butene, and an isobutylene, or the co-oligomer of ethylene and a propylene are

mentioned. the carbon number of this alkyl group or an alkenyl radical -- 30-300 -- it is 40-150 preferably. Since the cold-temperature fluidity of a lubricating oil constituent gets worse when the solubility over the lubricating oil base oil of a compound falls when the carbon number of an alkyl group or an alkenyl radical is less than 30, and the carbon number of an alkyl group or an alkenyl radical exceeds 300 on the other hand, it is not desirable respectively.

[0063] (F) although the content of the succinimid system ash-free dispersant of a component is arbitrary -- from points, such as abrasion resistance, oxidation stability, and a friction property, -- usually -- the nitrogen content -- 0.01 to 10 mass % -- the thing of 0.1 - 10 mass % is used desirably preferably. moreover, as a derivative of the succinimid system ash-free dispersant of the (F) component To succinimid which was mentioned above, for example, monocarboxylic acid (fatty acid etc.) and oxalic acid of carbon numbers 2-30, The polycarboxylic acid of the carbon numbers 2-30 of a phthalic acid, trimellitic acid, pyromellitic acid, etc. is made to act. Neutralize a part or all of the amino group which remains, and/or an imino group, or The amidated so-called acid denaturation compound; A boric acid is made to act on a nitrogen-containing compound which was mentioned above. Neutralize a part or all of the amino group which remains, and/or an imino group, or The amidated so-called boron denaturation compound; denaturation compound; which combined two or more sorts of denaturation chosen as sulfur denaturation compound; which made the sulfur compound act on a nitrogen-containing compound which was mentioned above, and a nitrogen-containing compound which was mentioned above from acid denaturation, boron denaturation, and sulfur denaturation is mentioned. In addition, in these derivatives, since it excels especially in the effectiveness that a boric-acid denaturation article raises a **** multiplier (mud), in order to emphasize this effectiveness, it is also effective to use the succinimid system ash-free dispersant which carried out boric-acid denaturation.

[0064] the case where one kind or two kinds or more of (F) components chosen as arbitration in the lubricating oil constituent of this invention are used together -- from points, such as abrasion resistance, oxidation stability, and a friction property, -- usually -- the nitrogen content -- 0.01 - 10 mass % -- the thing of 0.1 - 10 mass % is used desirably preferably. (F) the lower limit of the content of a component -- constituent whole-quantity criteria -- 0.1 mass % -- desirable -- 0.5 mass % -- it is -- on the other hand -- the upper limit -- constituent whole-quantity criteria -- 15.0 mass % -- it is 10.0 mass % preferably. (F) Since there is a possibility of the effectiveness of the (F) component not being acquired when the content of a

component does not fulfill 0.1 mass % with constituent whole-quantity criteria, but the cold-temperature fluidity of a lubricating oil constituent getting worse on the other hand when a content exceeds 15.0 mass % on constituent whole-quantity criteria, and having a bad influence on endurance, such as a sealant, it is not desirable respectively.

[0065] As mentioned above, in the lubricating oil constituent of this invention, when a lubricating oil constituent is used for a stick shift or an automatic transmission, and a tractor or a construction equipment by making lubricating oil base oil carry out the amount content of specification of the polysulfide compound of the (A) component, while holding highly the dynamic friction coefficient (mud) in the copper alloy which is the quality of the material of the wet oiling brake used by the synchronizer ring, tractor, or construction equipment used with a stick shift or an automatic transmission, a coefficient of static friction (microsecond) can be reduced.

[0066] Moreover, a friction property can be improved further further by carrying out the amount concomitant use of specification of one sort or two sorts or more of compounds chosen from (B) - (F) components if needed, respectively. That is, the lubricating oil constituent in this invention includes all the modes of the presentation which consists of various combination of lubricating oil base oil, the (A) component, and (B) - (F) component besides the presentation which blended the (A) component with lubricating oil base oil. Among these, especially the presentation containing the (B) component other than the (A) component is especially desirable, and the following modes are desirable.

(1) Base oil +(A)+(B) (2) base-oil +(A)+(B)+ (C), (D), (E), or (F), (3) — base oil +(A)+(B)+(C)+ (D), (E), or (F) — (4) — base oil +(A)+(B)+(C)+(D)+ (E) or (F) — (5) — base oil +(A)+(B)+(C)+ (D) — +(E)+(F) (6) base-oil +(A)+(B)+(D)+ (E) or (F) (7) base-oil +(A)+(B)+(D)+(E)+ (F).

As other desirable presentations, the presentation containing the (E) component other than the (A) component is desirable, and the following modes are mentioned.

(8) Base oil +(A)+(E) (9) base-oil +(A)+(E)+ (C), (D), or (F) (10) base-oil +(A)+(D)+(E)+ (C) or (F) (11) base-oil +(A)+(C)+(D)+(E)+ (F).

[0067] It is independent, or the various additives which are the purposes which raise the engine performance further, and are further represented by a viscosity index improver, a pour point depressant, an antioxidant, an extreme pressure additive, corrosion inhibitor, a rubber swelling agent, a defoaming agent, the coloring agent, etc. if needed may be combined in some numbers, and may be made to contain in the lubricating oil constituent of this invention. Specifically as a viscosity index improver, the so-called non-distributed viscosity index improvers, such as a polymer of one sort

chosen from various methacrylic ester or two sorts or more of monomers, a copolymer, or its water garnish, or the so-called distributed viscosity index improver to which copolymerization of the various methacrylic ester which contains a nitride further was carried out can be illustrated. As an example of other viscosity index improvers, non-distributed process input output equipment, distributed ethylene and an alpha olefin copolymer (a propylene, 1-butene, 1-pentene, etc. are mentioned as an alpha olefin) or its hydride, a polyisobutylene or its water garnish, a styrene-diene hydrogenation copolymer, a styrene-maleic-anhydride ester copolymer, poly alkyl styrene, etc. can be illustrated.

[0068] The molecular weight of these viscosity index improvers needs to select in consideration of shear stability. concrete -- the number average molecular weight of a viscosity index improver -- the case of distributed process input output equipment and non-distributed polymethacrylate -- 5,000-150,000 -- desirable -- the thing of 5,000-35,000 -- the case of a polyisobutylene or its hydride -- 800-5,000 -- desirable -- the thing of 1,000-4,000 -- the case of ethylene and an alpha olefin copolymer, or its hydride -- 800-150,000 -- the thing of 3,000-12,000 is preferably desirable. Moreover, especially when ethylene and an alpha olefin copolymer, or its hydride is used also in these viscosity index improvers, the lubricating oil constituent excellent in shear stability can be obtained.

[0069] Although one kind or two kinds or more of compounds chosen as arbitration from these can make the amount of arbitration contain, as for the content, it is usually desirable that it is 0.1 to lubricating oil constituent whole-quantity criteria 40.0 mass %. It is usable if it is used to a lubricating oil generally [a phenol system compound, an amine system compound, etc.] as an antioxidant. Specifically Alkylphenols, such as 2 and 6-G tert-butyl-4-methyl phenol Bisphenols, such as methylene -4 and 4-bisphenol (2, 6-G tert-butyl-4-methyl phenol) Naphthylamines, such as a phenyl-alpha-naphthylamine, and dialkyl diphenylamine Fatty acids (3, 5-G tert-butyl-4-hydroxyphenyl), univalent, or polyhydric alcohol, such as a propionic acid (3, 5-G tert-butyl-4-hydroxyphenyl) (For example, ester with a methanol, OKUTA decanol, 1, 6-hexa polysulfide, neopentyl glycol, thiodiethylene glycol, triethylene glycol, pentaerythritol, etc.) etc. is mentioned. Although one kind or two kinds or more of compounds chosen as arbitration from these can make the amount of arbitration contain, as for the content, it is usually desirable that it is 0.01 to 5.0 mass % on lubricating oil constituent whole-quantity criteria.

[0070] As an extreme pressure additive, as for everything but the polysulfide compound of the (A) component which is an indispensable component of this

invention, sulfur system compounds, such as for example, disulfide and sulfurized oil fat, etc. are mentioned. Although one kind or two kinds or more of compounds chosen as arbitration from these can make the amount of arbitration contain, as for the content, it is usually desirable that it is 0.01 to 5.0 mass % on lubricating oil constituent whole-quantity criteria. As corrosion inhibitor, a benzotriazol system, a thiadiazole system, an imidazole system compound, etc. are mentioned, for example. Although one kind or two kinds or more of compounds chosen as arbitration from these can make the amount of arbitration contain, as for the content, it is usually desirable that it is 0.01 to 3.0 mass % on lubricating oil constituent whole-quantity criteria. As a defoaming agent, silicone, such as dimethyl silicone and fluoro silicone, is mentioned, for example. Although one kind or two kinds or more of compounds chosen as arbitration from these can make the amount of arbitration contain, as for the content, it is usually desirable that it is 0.001 to 0.05 mass % on lubricating oil constituent whole-quantity criteria. Although a coloring agent can make the amount of arbitration contain, as for the content, it is usually desirable that it is 0.001 to 1.0 mass % on lubricating oil constituent whole-quantity criteria.

[0071]

[Effect of the Invention] As mentioned above, the lubricating oil constituent of this invention has the outstanding extreme pressure property and the outstanding friction property, and fits the use as a lubricating oil for power transmission devices, such as a lubricating oil for common lubrication which carries out the lubrication of the change gear used for the hand control or the lubricating oil for automatic transmissions which used the synchronizer ring especially, a tractor, or a construction equipment, and the brake to coincidence.

[0072]

[Example] Hereafter, although an example and the example of a comparison explain the contents of this invention still more concretely, this invention is not limited at all by these.

[0073] In order to evaluate the friction property in the copper alloy which is the quality of the material of the wet oiling brake used by the synchronizer ring used with [trial 1] hand control or an automatic transmission, or tractor, about the lubricating oil constituent shown in Table 1, the synchro friction test was performed on the conditions shown below, and coefficient-of-static-friction mus after running-in 1000 cycle progress (a synchronizer ring shows the maximum coefficient of friction after slip initiation by 1rpm from a quiescent state microsecond.) was measured.

[0074]

Service condition of a synchro friction test Synchronizer ring: Copper alloy
synchronizer ring for domestic stick shifts Gear cone : Steel gear cone for domestic
manual automatic transmissions Oil **: 80 degrees C Motor rotational frequency :
1200rpm Forcing load : 400Ns Forcing cycle : ON 0.5 sec/OFF 1.0sec[0075]

[Table 1]

	組成 [質量%]		シンクロ 摩擦係数 $\mu_{1200}^{7)}$
	(A) 成分を 除く潤滑油	(A) 成分	
実施例1	精製鉱油A ¹⁾	ポリサルファイド化合物A ⁴⁾ [0.5] ⁸⁾	0.091
実施例2	精製鉱油A ¹⁾	ポリサルファイド化合物B ⁵⁾ [0.5] ⁸⁾	0.098
比較例1	精製鉱油A ¹⁾	—	0.085
比較例2	精製鉱油A ¹⁾	ポリサルファイド化合物C ⁶⁾ [0.5] ⁸⁾	0.036
実施例3	潤滑油A ²⁾	ポリサルファイド化合物A ⁴⁾ [0.5] ⁸⁾	0.094
実施例4	潤滑油A ²⁾	ポリサルファイド化合物B ⁵⁾ [0.5] ⁸⁾	0.096
比較例3	潤滑油A ²⁾	ポリサルファイド化合物C ⁶⁾ [0.5] ⁸⁾	0.052
実施例5	潤滑油B ³⁾	ポリサルファイド化合物A ⁴⁾ [0.5] ⁸⁾	0.090
実施例6	潤滑油B ³⁾	ポリサルファイド化合物B ⁵⁾ [0.5] ⁸⁾	0.092
比較例4	潤滑油B ³⁾	ポリサルファイド化合物C ⁶⁾ [0.5] ⁸⁾	0.042

[0076] 1) Purification mineral oil A : paraffin series hydrocracking mineral oil of
kinematic viscosity 4.1mm²/s (@100 degree C) and a viscosity index 123.

2) Lubricating oil A : the kinematic viscosity of 13.6mm²/s (@100 degree C)
lubricating oil which added polymethacrylate 20 mass %, G 2-ethylhexyl
alkyl-acid-phosphate amine salt 0.3 mass %, and thiadiazole 0.2 mass % on constituent
whole-quantity criteria to purification mineral oil A.

3) Lubricating oil B : the kinematic viscosity of 14.8mm²/s (@100 degree C)
lubricating oil which added polymethacrylate 20 mass %, dibutyl phosphite 0.2 mass %,
basic primary ZnDTP1.2 mass %, TBN300calcium sulfonate 2.0 mass %, alkenyl
succinimid 0.5 mass %, and sorbitan mono-olate 0.3 mass % on constituent
whole-quantity criteria to purification mineral oil A.

4) polysulfide compound A: -- a formula (1) -- setting -- the carbon number 8 of
R1-R3, and n= -- 0-1x, and the polysulfide compound of y=3-9.

5) polysulfide compound B: -- a formula (1) -- setting -- the carbon numbers 16 or 18

of R1-R3, and $n = 0-1x$, and the polysulfide compound of $y=1-9$.

6) polysulfide compound C: -- a formula (1) -- setting -- the carbon number 4 of R1-R3, and $n = 0-1x$, and the polysulfide compound of $y=2-13$.

7) Coefficient of friction of 1200rpm after $\mu_{1200:10000}$ cycle. 8 [0.5]: The polysulfide compound was added so that it might become sulfur 0.5 mass % on constituent whole-quantity criteria.

[0077] A passage clear from the result of Table 1, the lubricating oil constituent of the example containing (A) polysulfide compound concerning this invention has the high dynamic friction coefficient μ_{1200} in the copper alloy used by the wet oiling brake of hand control or the synchromesh device of an automatic transmission, or a tractor, and can prevent the fall of coefficient of friction at the time of the synchro with which it becomes the cause of synchromesh mold hand control or gear **** in an automatic transmission.

[0078] About the lubricating oil constituent of [trial 2] this invention, in order to evaluate the effect on a friction property, the coefficient of static friction μ_1 of each presentation shown in Table 1 was measured with the synchro friction tester. The result was shown in Table 2.

[0079]

Service condition of a synchro friction test Synchronizer ring: Copper alloy
synchronizer ring for domestic stick shifts Gear cone : Steel gear cone for domestic
manual automatic transmissions Oil **: 80 degrees C Motor rotational frequency :
After [an inertia absorption test] 1rpm Forcing load : 400Ns Forcing cycle :- 2.0
sec/OFF 5.0sec[0080]

[Table 2]

	組成 [質量%]		シンクロ 摩擦係数 μ_1 ⁷⁾
	(A) 成分を 除く潤滑油	(A) 成分	
実施例 7	精製鉱油 A ¹⁾	ポリサルファイド化合物 A ⁴⁾ [0.5] ⁸⁾	0.158
実施例 8	精製鉱油 A ¹⁾	ポリサルファイド化合物 B ⁵⁾ [0.5] ⁸⁾	0.112
比較例 5	精製鉱油 A ¹⁾	—	0.169
比較例 6	精製鉱油 A ¹⁾	ポリサルファイド化合物 C ⁶⁾ [0.5] ⁸⁾	0.173
実施例 9	潤滑油 A ²⁾	ポリサルファイド化合物 A ⁴⁾ [0.5] ⁸⁾	0.152
実施例 10	潤滑油 A ²⁾	ポリサルファイド化合物 B ⁵⁾ [0.5] ⁸⁾	0.103
比較例 7	潤滑油 A ²⁾	ポリサルファイド化合物 C ⁶⁾ [0.5] ⁸⁾	0.162
実施例 11	潤滑油 B ³⁾	ポリサルファイド化合物 A ⁴⁾ [0.5] ⁸⁾	0.140
実施例 12	潤滑油 B ³⁾	ポリサルファイド化合物 B ⁵⁾ [0.5] ⁸⁾	0.096
比較例 8	潤滑油 B ³⁾	ポリサルファイド化合物 C ⁶⁾ [0.5] ⁸⁾	0.165

[0081] 1) Purification mineral oil A : the same as that of the purification mineral oil A of Table 1.

2) Lubricating oil A : the same as that of the lubricating oil A of Table 1.

3) Lubricating oil B : the same as that of the lubricating oil B of Table 1.

4) Polysulfide compound A : the same as that of the polysulfide compound A of Table 1.

5) Polysulfide compound B : the same as that of the polysulfide compound B of Table 1.

6) Polysulfide compound C : the same as that of the polysulfide compound C of Table 1.

7) μ_1 : the maximum coefficient of friction of 1rpm after after [an inertia absorption test] 100 cycle.

8) [0.5]: The polysulfide compound was added so that it might become sulfur 0.5 mass % on constituent whole-quantity criteria.

[0082] In the lubricating oil constituent of this invention, the examples 8, 10, and 12 using the polysulfide compound B long-chain in R1-R3 in especially a formula (1) show remarkable low μ_1 as compared with the corresponding examples 5-8 of a comparison a passage clear from the result of Table 2. This means that coefficient of friction in low sliding velocity is low, and shows that it is effective in prevention of the

connection phenomenon in hand control or the synchromesh device of an automatic transmission, or the brake-noise prevention by the wet oiling brake of a tractor.

[0083] In order to evaluate the effect of the brake noise on a tractor by the lubricating oil constituent concerning [trial 3] this invention, about the lubricating oil constituent of example of example 13 ***** 9 which has the presentation shown in Table 3, on the conditions shown below, the tractor brake-noise trial when the oil temperature of 5 degrees C and an oil temperature is the same as that of outside air temperature was performed, and the result was shown in Table 3.

[0084] tractor-brake-noise trial (1) use tractor: — 15 horsepower tractor (2) test-method: — the tractor first filled up with the trial oil is cooled in a cool room (0 degree C) for 12 hours or more. An oil temperature is measured, after accelerating without pre-heating the tractor taken out from the cool room to 30km/h, applying full brakes and hearing generating of a sound. This is twice considered as the trial of 5 degrees C of repeats. Full brakes are applied in the place where transit was furthermore repeated at and the oil temperature amounted to 30 degrees C, and generating of a sound is heard. This is twice considered as the trial of repeat outside air temperature.

[0085]

[Table 3]

		実施例 1 3	比較例 9
組成	潤滑油	潤滑油 C ¹⁾	潤滑油 C ¹⁾
	(A) 成分	ポリサルファイド 化合物 B ²⁾ [0. 5] ⁴⁾	ポリサルファイド 化合物 C ³⁾ [0. 5] ⁴⁾
ブレーキ鳴き試験	油温 5℃	鳴き小	鳴き大
	油温 外気温	鳴きなし	鳴き中

[0086] 1) Lubricating oil C : the kinematic viscosity of 9.1mm²/s (@100 degree C) lubricating oil which added polymethacrylate 7.5 mass %, basic primary ZnDTP1.8 mass %, TBN100calcium sulfonate 2.0 mass %, TBN300calcium sulfonate 1.5 mass %, and oleylamide 0.1 mass % on constituent whole-quantity criteria to purification mineral oil A.

2) Polysulfide compound B : the same as that of the polysulfide compound B of Table 1.

3) Polysulfide compound C : the same as that of the polysulfide compound C of Table

1.

4) [0.5]: The polysulfide compound was added so that it might become sulfur 0.5 mass % on constituent whole-quantity criteria.

[0087] It turns out that the lubricating oil constituent (example 13) of this invention is excellent in the prevention effectiveness of the brake noise of a tractor a passage clear from the result of Table 3.

[Translation done.]

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(71) 出願人 000004444

日石三菱株式会社

東京都港区西新橋1丁目3番12号

(72) 発明者 白濱 真一

神奈川県横浜市中区千鳥町8番地 日石三菱株式会社潤滑油部潤滑油研究所内

(72) 発明者 大川 哲夫

東京都港区西新橋一丁目3番12号 日石三菱株式会社潤滑油部内

(74) 代理人 100103285

弁理士 森田 順之 (外1名)

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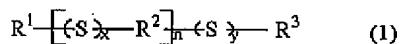
(54) 【発明の名称】 潤滑油組成物

(57) 【要約】

【課題】 特に、自動車の手動または自動変速機油や、トラクターや建設機械の共通潤滑用潤滑油等の動力伝達機構用潤滑油としての使用に適する極圧性と摩擦特性に優れた潤滑油組成物を提供する。

【解決手段】 潤滑油基油に、下記式 (1) で表されるポリサルファイド化合物を組成物全量基準で0.01～10.0質量%を含有させることにより優れた極圧性と摩擦特性を有する潤滑油組成物が得られる。

【化1】

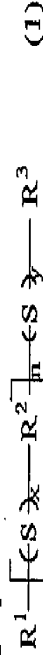


(式 (1) 中、 R^1 および R^3 は炭素数6～30のアルキル基又はアルケニル基であり、 R^2 は炭素数6～30のアルキレン基を示す。 x および y はそれぞれ独立に1～15であり、 n は0～2である。)

【特許請求の範囲】

【請求項 1】 潤滑油基油に、下記式 (1) で表されるポリサルファイド化合物を組成物全量基準で 0. 0 1 ～ 1 0. 0 質量%含有してなることを特徴とする潤滑油組成物。

【化 1】

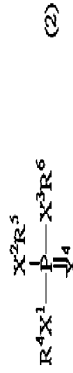


(式 (1) 中、R¹ および R³ は炭素数 6 ～ 3 0 のアルキル基又はアルケニル基であり、それぞれ同一であっても異なる基を示す。x および y はそれぞれ独立に 1 ～ 1 5 であり、n は 0 ～ 2 である。)

【請求項 2】 式 (1) 中、R¹ および R³ は炭素数 1 0 ～ 3 0 のアルキル基又はアルケニル基であり、R² は炭素数 1 0 ～ 3 0 の潤滑油組成物であることを特徴とする請求項 1 に記載の潤滑油組成物。

【請求項 3】 請求項 1 又は 2 に記載の潤滑油組成物において、さらに下記式 (2) で表されるリン酸エステル、下記式 (3) で表される亜リン酸エステル、およびこれらリン系化合物の誘導体の中から選ばれる 1 種の化合物又は 2 種以上の化合物の混合物を組成物全量基準でリン元素量として 0. 0 0 5 ～ 0. 5 質量%含有してなることを特徴とする潤滑油組成物。

【化 2】



(式 (2) 中、R⁴、R⁵、R⁶ 及び R⁷ は、それぞれ個別に、水素原子又は炭素数 1 ～ 3 0 の炭化水素基を示し、かつ、R⁴、R⁵ 及び R⁶ のうち少なくとも 1 つは炭化水素基であり、X¹、X²、X³、X⁴ 及び X⁵ は、それぞれ個別に、酸素原子又は硫黄原子を示す。)

【化 3】



(式 (3) 中、R⁷、R⁸、R⁹ 及び R¹⁰ は、それぞれ個別に、水素原子又は炭素数 1 ～ 3 0 の炭化水素基を示し、かつ、R⁷、R⁸ 及び R⁹ のうち少なくとも 1 つは炭化水素基であり、X⁶、X⁷ 及び X⁸ は、それぞれ個別に、酸素原子又は硫黄原子を示す。)

【請求項 4】 請求項 1、2 又は 3 に記載の潤滑油組成物において、さらに下記式 (7) で表されるジチオリン酸亜鉛を組成物全量基準で 0. 0 5 ～ 5. 0 質量%含有してなることを特徴とする潤滑油組成物。

【化 4】



(式 (7) 中、R²¹、R²²、R²³、R²⁴ 及び R²⁵ は、それぞれ

個別に、炭素数 1 ～ 1 8 のアルキル基若しくはアリール基、又は炭素数 7 ～ 1 8 のアルキルアリール基を示す。)

【請求項 5】 手動変速機用または自動変速機用潤滑油であることを特徴とする請求項 1、2、3 又は 4 に記載の潤滑油組成物。

【請求項 6】 トラクター及び建設機械用共通潤滑用潤滑油であることを特徴とする請求項 1、2、3 又は 4 に記載の潤滑油組成物。

【発明の詳細な説明】

【0 0 0 1】

【発明の属する技術分野】 本発明は潤滑油組成物に関し、詳しくは、優れた摩擦特性とその持続性を有し、特に摩擦により影響をうける部位を持つ機構に使用される潤滑油組成物に関する。具体的には、シクロロナイザリングを使用した手動変速機用または自動変速機用潤滑油や、トラクターや建設機械に使用される変速機とブレーキを同時に潤滑する共通潤滑用潤滑油等の動力伝達機構用の潤滑油としての使用に特に適する潤滑油組成物に関する。

【0 0 0 2】

【従来の技術】 一般にギヤ油には S P 系添加剤と呼ばれるイオウ系添加剤とリン系添加剤が主成分とする添加工剤が使用される。これはこの添加工剤が極圧性と呼ばれる耐摩耗性や耐焼き付き性に優れた性能をもつためである。ところがシクロロナイザリング機構にシクロロナイザリングを使用した自動車用手動または自動変速機では、変速時にシクロロナイザリングとギヤコーンの間に十分な動摩係数がないと、なかなか同期せず変速に時間を要したり、変速操作に過度の力が必要になる。また変速時にシクロロナイザリングとギヤコーンの間の静摩擦係数が高くと引掛かりと呼ばれる不具合が生じ易い。これは変速操作時、いったん静止したシクロロナイザリングを若干ギヤコーン上で滑らす必要があり、このときの静摩擦係数が高いと引掛かりが発生するためである。

【0 0 0 3】 従来使用されている S P 系添加剤はこの摩擦特性を悪化させることが知られている。特に S P 系添加工剤の主成分の一つである公知のポリサルファイドは銅系シクロロナイザリングの摩耗を促進するため急激な動摩係数の低下を招き、また静摩擦係数も非常に高いために S P 系添加工剤の手動または自動変速機用潤滑油組成物では十分な変速操作性が得られていなかった。一方、トラクターや建設機械では変速機と車輪のブレーキは同じ潤滑油で潤滑する共通潤滑がほとんどである。このため、使用する潤滑油にはギヤ油としての高い極圧性と同時にブレーキ鳴き防止の性能が要求される。ブレーキ鳴きは温式ブレーキ (温式摩擦機構を利用したブレーキ) のステイックスリップ又は自励振動によって発生する。これを防ぐには、より低速滑り条件で摩擦係数を下

使用される。しかしながら従来のトラクター用もしくは建設機械の潤滑油組成物の性能は十分でなく、しばしばブレーキ鳴きを生じ製品のクレームが発生していた。

【0004】

【発明が解決しようとする課題】そこで、本発明は、このような実情に鑑みなされたものであり、その目的は、特に、自動車の手動変速機油または自動変速機油や、トラクターや建設機械の共通潤滑油等の動力伝達機構用潤滑油としての使用に適する、優れた極圧性と摩擦特性を有する潤滑油組成物を提供することにある。

【0005】

【課題を解決するための手段】すなわち、本発明は、潤滑油基油に、下記一般式(1)で表されるポリサルファイド化合物を組成物全量基準で0.01～10.0質量%含有してなることを特徴とする潤滑油組成物である。

【0006】

【化5】



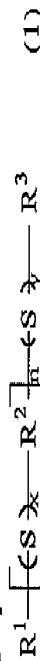
(式(1)中、R¹およびR³は炭素数6～30のアルキル基又はアルケニル基であり、それぞれ同一であっても異なってもよい。またR²は炭素数6～30のアルキル基を示す。xおよびyはそれぞれ独立に1～15であり、nは0～2である。)

【0007】

【発明の実施の形態】以下、本発明の内容をさらに詳細に説明する。本発明の潤滑油組成物は、潤滑油基油に、(A)下記一般式(1)で表されるポリサルファイド化合物を組成物全量基準で0.01～10.0質量%含有する。

【0008】

【化6】



(式(1)中、R¹およびR³は炭素数6～30のアルキル基又はアルケニル基であり、それぞれ同一であっても異なってもよい。またR²は炭素数6～30のアルキル基を示す。xおよびyはそれぞれ独立に1～15であり、nは0～2である。)

【0009】式(1)において、R¹およびR³はそれぞれ個別に炭素数6～30のアルキル基又はアルケニル基である。R²は炭素数6～30のアルキル基である。R¹～R³の炭素数が6未満や30を越える場合は、潤滑油の摩擦特性が悪化するため、それぞれ好ましくない。さらに、静摩擦係数の低減効果という点で、R¹～R³の炭素数は10～30であることが好ましく、12～24であることが特に好ましい。また、x、yはそれぞれ独立に1～15の整数であるが、化合物としての安定性や腐食性という面で、それぞれ10以下であることが好ましい。なお「-(S_x-R²-)」で示される各繰り返し単位の

中のxは、他の繰り返し単位の中のxとおおの独立であり、それぞれ異なってもよくまた同じであっても良い。

【0010】R¹およびR³としては、具体的には例えば、ヘキシル基、ヘプチル基、オクチル基、ノニル基、デシル基、ウンデシル基、ドデシル基、トリデシル基、テトラデシル基、ペンタデシル基、ヘキサデシル基、ヘプタデシル基、オクタデシル基、ノナデシル基、イコシル基、ヘンイコシル基、ドコシル基、トリコシル基、テトラコシル基、ペンタコシル基、ヘキサコシル基、ヘプタコシル基、オクタコシル基、ノナコシル基、トリアコシル基等のアルキル基（これらアルキル基は直鎖状でも分枝状でも良い）；ヘキセニル基、ヘプタセニル基、オクタセニル基、ノネニル基、デセニル基、ウンデセニル基、ドデセニル基、トリデセニル基、テトラデセニル基、ペンタデセニル基、ヘキサデセニル基、ヘプタデセニル基、オクタデセニル基、ノナデセニル基、トリコセニル基、ドコセニル基、ヘンイコセニル基、ドコセニル基、トリコセニル基、テトラコセニル基、ペンタコセニル基、ヘキサコセニル基、ヘキセニル基、ヘプタコセニル基、オクタコセニル基、ノナコセニル基、トリアコセニル基等のアルケニル基（これらアルケニル基は直鎖状でも分枝状でも良く、また二重結合の位置も任意である）；等が挙げられる。またアルキル基又はアルケニル基は、摩擦特性に優れる点から直鎖状が好ましい。さらに酸化安定性の面からアルキル基が好ましい。

【0011】R²としては、具体的には、ヘキシレン基、ヘプタレン基、オクタレン基、ノニレン基、デシレン基、ウンデシレン基、ドデシレン基、トリデシレン基、テトラデシレン基、ペンタデシレン基、ヘキサデシレン基、ヘプタデシレン基、オクタデシレン基、ノナデシレン基、イコシレン基、ヘンイコシレン基、ドコシレン基、トリコシレン基、テトラコシレン基、ペンタコシレン基、ヘキサコシレン基、ヘプタコシレン基、オクタコシレン基、ノナコシレン基、トリアコシレン基等のアルキレン基（これらアルキレン基は直鎖状でも分枝状でも良い）が挙げられる。

【0012】本発明のポリサルファイド化合物中の硫黄の含有量としては特に制限はないが、その下限は5質量%、好ましくは15質量%である。硫黄の含有量が少なすぎると化合物としての反応性が落ちたり、極圧性が低下するおそれがある。また、その上限は70質量%、好ましくは60質量%である。硫黄の含有量が多すぎると化合物として不安定になり、貯蔵安定性に問題がでたり、反応性が高すぎ腐食性が高くなるというおそれがある。また、本発明の潤滑油組成物においては、ポリサルファイド化合物として、式(1)で表される構造の異なる2種以上のポリサルファイド化合物の混合物も用いることができる。

【0013】本発明の潤滑油組成物においては、式

(1) で表されるポリサルファイド化合物（以下 (A) 成分ともいう。）を含有することにより、潤滑油組成物が手動または自動変速機や、トラクターあるいは建設機械に用いられた場合、手動または自動変速機で使用されるシシクロナイザリングや、トラクターもしくは建設機械で使用される湿式ブレーキの材質である銅合金での動摩係数（ μ_d ）を高く保持するとともに、静摩係数（ μ_s ）を低下させることができる。本発明の潤滑油組成物における (A) 成分の含有量の下限値は、組成物全質量基準で 0.01 質量%、好ましくは 0.05 質量%であり、一方、その上限値は、組成物全質量基準で 10.0 質量%、好ましくは 5.0 質量%である。本発明のポリサルファイド化合物の含有量が組成物全質量基準で 0.01 質量%に満たない場合は、ポリサルファイド化合物配合による極圧性ならびに磨擦特性の改善効果に乏しく、一方、含有量が組成物全質量基準で 10.0 質量%を越える場合は、ポリサルファイドの腐食性が大きくなり過ぎるため、それぞれ好ましくない。

【O O 1 4】また、本発明の潤滑油組成物における基油としては、通常の潤滑油の基油として用いられる任意の鉱油及び／又は合成油が使用できる。鉱油としては、例えば、原油を常圧蒸留して得られる常圧残油を減圧蒸留して得られた潤滑油留分を、溶剤脱れき、水素化精製、硫酸洗浄、白土処理等の各種精製処理等を適宜組み合わせて精製したパラフィン系、ナフテン系等の油やノルマルパラフィン等が使用できる。

【0015】また合成油としては、特に制限はないが、ポリ- α -オレフィン（1-オクタデシノリゴマー、1-デセノリゴマー、エチレン-プロピレンオリゴマー等）及びその水素化物、インプテンオリゴマー及びその水素化物、インパラフィン、アルキルベンゼン、アルキルナフタレン、ジエステル（ジトリデシルグルタレート、ジ2-エチルデシルアジペート、ジトリデシルアジペート、ジ2-エチルヘキシルセバケート等）、ポリオールエステル（トリメチロールプロパンカプリレート、トリメチロールプロパンペラルゴネート、ペンタエリスリトール2-エチルヘキサンエート、ペンタエリスリトールペラルゴネート等）、ポリオキシアルキレングリコール、ジアルキルジフエニルエーテル、並びにポリフエニルエーテル等が使用でき、なお、これら潤滑油基油の動粘度は、特に限定されず任意であるが、通常、 100°C における動粘度が $1 \sim 50 \text{ mm}^2/\text{s}$ 、好ましくは $2 \sim 20 \text{ mm}^2/\text{s}$ であるものを用いるのが望ましい。

【0016】また、本発明の潤滑油組成物は、さらに(B)リン系化合物を含有することができる。リン系化合物(以下(B)成分ともいう。)を併用することにより、潤滑油組成物の極圧性能をさらに改善し、初期から優れた摩擦特性を発揮することが可能となる。(B)成

式(3)中、 R' 、 R'' 及び R''' は、それぞれ個別に、水素原子又は炭素数1〜30の炭化水素基を示し、かつ、 R' 、 R'' 及び R''' のうち少なくとも1つは炭化水素基であり、 X^a 、 X^b 及び X^c は、それぞれ個別に、酸素原子又は硫黄原子を示す。

【0019】上述したとおり、 R^1 、 R^2 、 R^3 、 R^4 、 R^5 、 R^6 、 R^7 、 R^8 及び R^9 は、それぞれ個別に、水素原子又は炭素数1～30の炭化水素基であり、好ましくは水素原子又は炭素数3～30の炭化水素基、より好ましくは水素原子又は炭素数4～24の炭化水素基を示す。ここで、 R^1 、 R^2 及び R^3 のうち少なくとも1つは炭化水素基であり、 R^4 、 R^5 及び R^6 のうち少なくとも1つは炭化水素基である。 R^7 及び R^8 の少なくとも1つは炭化水素基である。 R^9 が30を超える場合は、潤滑油組成物の摩擦特性が悪化するため好ましくない。

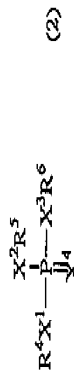
【0020】このような炭素数1〜30の炭化水素基として、具体的には例えば、メチル基、エチル基、プロピル基、ブチル基、ペンチル基、ヘキシル基、ヘプチル基、オクチル基、ノニル基、デシル基、ウンデシル基、ドデシル基、トリデシル基、テトラデシル基、ペンタデシル基、ヘキサデシル基、ヘプタデシル基、オクタデシル基、ノナデシル基、イコシル基、ヘンイコシル基、ドコシル基、トリコシル基、テトラコシル基、ペンタコシル基、ヘキサコシル基、ヘプタコシル基、オクタコシル基、ノナコシル基、トリアコンチル基等のアルキル基

(これらアルキル基は直鎖状でも分枝状でも良い) ; プ
テニル基、ペンテニル基、ヘキセニル基、ヘプテニル
基、オクタテニル基、ノネニル基、デセニル基、ウン
デニル基、ドデセニル基、トリデセニル基、テトラ
デニル基、ペンタデセニル基、ヘキサデセニル基、

(2) で表されるリン酸エステル、およびこれらリン系化合物の誘導体の中から選ばれた 1 種の化合物又は 2 種以上の化合物の混合物等が挙げられる。

【0017】

【イキア】



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セニル基、オクタデセニル基、ノナデセニル基、イコセニル基、ヘンイコセニル基、ドコセニル基、トリコセニル基、テトラコセニル基、ペンタコセニル基、ヘキサコセニル基、ヘプタコセニル基、オクタコセニル基、ノナコセニル基、トリアコンテニル基等のアルケニル基（これらアルケニル基は直鎖状でも分枝状でも良く、また二重結合の位置も任意である）；シクロペンチル基、シクロヘキシル基、シクロヘプチル基等の炭素数5～7のシクロペンチル基；メチルシクロペンチル基、ジメチルシクロペンチル基、メチルシクロヘキシル基、ジメチルシクロヘキシル基、メチルシクロヘキシル基、ヘプチルシクロヘキシル基、ジメチルシクロヘキシル基、メチルシクロヘキシル基、メチルシクロヘキシル基、ヘプチルシクロヘキシル基、オクタデシル基、ノニル基、ドデシル基等の炭素数7～12の各アリールアルキル基（アルキル基は直鎖状でも分枝状でも良く、また二重結合の位置も任意である）等が挙げられるが、これらの中でもアルキル基、アルケニル基、アリール基又はアルキルアリール基であるのが好ましい。

【0021】また、リン系化合物の誘導体としては、具体的には例えば、リン酸、亜リン酸、前記式(2)においてR¹、R²及びR³のうち1つ又は2つが水素である酸性リン酸エステル若しくは前記式(3)においてR¹、R²及びR³のうち1つ又は2つが水素である酸性リン酸エステル等のリン系化合物に、アンモニアや炭素数1～8の炭化水素基又は水酸基含有炭化水素基のみを分子中に含有するアミン化合物等の含窒素化合物を用させて、残存する酸性水素の一部又は全部を中和した塩等が挙げられる。

【0022】この含窒素化合物としては、具体的には例えば、アンモニア；モノメチルアミン、モノエチルアミン、モノプロピルアミン、モノブチルアミン、モノペンチルアミン、モノヘキシルアミン、モノヘプチルアミン、モノオクタールアミン、ジメチルアミン、メチルエチルアミン、ジエチルアミン、メチルプロピルアミン、エチルプロピルアミン、ジプロピルアミン、メチルブチルアミン、エチルブチルアミン、プロピルブチルアミン、ジブチルアミン、ジペンチルアミン、ジヘキシルアミ

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ン、ジヘプチルアミン、ジオクタールアミン等のアルキルアミン（アルキル基は直鎖状でも分枝状でも良い）；モノメチルアミン、モノエチルアミン、モノプロピルアミン、モノブチルアミン、モノペンチルアミン、モノヘキシルアミン、モノヘプチルアミン、モノオクタールアミン、モノノナールアミン、ジメチルアミン、メタノールエタノールアミン、ジエタノールアミン、メタノールプロパノールアミン、エタノールプロパノールアミン、ジプロパノールアミン、メタノールブタノールアミン、エタノールブタノールアミン、ジブタノールアミン、ジペンタノールアミン、ジヘキサノールアミン、ジヘプタノールアミン、ジオクタノールアミン等のアルカノールアミン（アルカノール基は直鎖状でも分枝状でも良い）；及びこれらの混合物等が挙げられる。

【0023】(B)成分のリン系化合物としては、摩擦特性により優れる点から、前記式(2)においてR¹、R²及びR³のうち1つ又は2つが水素である酸性リン酸エステル若しくは前記式(3)においてR¹、R²及びR³のうち1つ又は2つが水素である酸性リン酸エステル、又は上述したようなこれらリン系化合物のアミン塩、アルカノールアミン塩等がより好ましく用いられる。

【0024】(B)成分として特に好ましい化合物としては、具体的には、モノブチルホスフェート、モノペンチルホスフェート、モノヘキシルホスフェート、モノブチルホスフェート、モノオクタールホスフェート、モノノニルホスフェート、モノデシルホスフェート、モノウンデシルホスフェート、モノドデシルホスフェート、モノトリデシルホスフェート、モノテトラデシルホスフェート、モノヘキサデシルホスフェート、モノヘプタデシルホスフェート、モノオクタデシルホスフェート、モノノナデシルホスフェート、モノイコシルホスフェート、モノヘンイコシルホスフェート、モノドコシルホスフェート、モノトリコシルホスフェート、モノテトラコシルホスフェート等のモノアルキルホスフェート（アルキル基は直鎖状でも分枝状でも良く、またオクタールホスフェート等のモノアルケニルホスフェート（アルケニル基は直鎖状でも分枝状でも良く、二重結合の位置も任意であり、またオクタールホスフェート等であっても良い）；モノフェニルホスフェート等のモノ（アルキル）アリールホスフェート（アルキル基の置換位置は任意であり、またオクタールホスフェート、ジペンチルホスフェート、ジヘキシルホスフェート、ジブチルホスフェート、ジオクタールホスフェート、ジノニルホスフェート、ジデシルホスフェート、ジウンデシルホスフェート、ジドデシルホスフェート、ジトリデシルホスフェート、ジテトラデシルホスフェ

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ル基（これらのアルケニル基は直鎖状でも分枝状でも良く、また二重結合の位置も任意である）；シクロペンチル基、シクロヘキシル基、シクロヘブチル基等の炭素数 5～7 のシクロアルキル基；メチルシクロペンチル基、ジメチルシクロペンチル基、メチルエチルシクロペンチル基、ジェチルシクロペンチル基、メチルシクロヘキシル基、ジメチルシクロヘキシル基、メチルエチルシクロヘキシル基、ジェチルシクロヘキシル基、メチルエチルシクロヘブチル基、ジエチルシクロヘブチル基等の炭素数 6～11 のアルキル基；トリル基、キシリル基、エナフチル基等のアリール基；プロピルフェニル基、ブチルフェニル基、ペンチルフェニル基、ヘキシルフェニル基、ヘプチルフェニル基、オクタシルフェニル基、ノニルフェニル基、デシルフェニル基、ウンデシルフェニル基、ドデシルフェニル基等の炭素数 7～18 の各アルキルアリール基（アルキル基は直鎖状でも分枝状でも良く、また置換位置も任意である）；ベンジル基、フェニルエチル基、フェニルプロピル基、フェニルブチル基、フェニルペンチル基、フェニルヘキシル基等の炭素数 7～12 の各アリールアルキル基（アルキル基は直鎖状でも分枝状でも良く、また置換位置も任意である）；等が挙げられる。

【0035】前記式(4)で表される脂肪酸モノアミン又はそのアルキレンオキシド付加物としては、摩擦特性により優れる点から、式(4)において、 R^{1a} 及び R^{1b} が、別個に水素又は炭素数 1～6 のアルキル基であり、かつ $a = b = 0$ である脂肪酸モノアミンや、 R^{1a} 及び R^{1b} が水素であり、かつ a 及び b が別個に 0～6 であり $a + b = 1$ ～6 となる数である脂肪酸モノアミンのアルキレンオキシド付加物により好ましく用いられる。また、前記式(5)で表される脂肪酸ポリアミンとしては、摩擦特性により優れる点から、式(5)において、 R^{1a} 及び R^{1b} が、別個に水素又は炭素数 1～6 のアルキル基である脂肪酸ポリアミンがより好ましく用いられる。また、前記式(6)で表されるイミダズリン化合物としては、摩擦特性により優れる点から、式(6)において R^{1a} が、水素又は炭素数 1～6 のアルキル基であるイミダズリン化合物がより好ましく用いられる。

【0036】一方、(C-1)でいうアミン化合物の誘導体としては、例えば、前記式(4)～(6)のようなアミン化合物に炭素数 2～30 のモノカルボン酸（脂肪酸等）や、シユウ酸、フタル酸、トリメルिट酸、ピロメリット酸等の炭素数 2～30 のポリカルボン酸を作用させて、残存するアミノ基及び／又はイミノ基の一部又は全部を中和したり、アミド化した、いわゆる酸変性化合物；式(4)～(6)のようなアミン化合物にホウ酸を作用させて、残存するアミノ基及び／又はイミノ基の一部又は全部を中和した、いわゆるボウ酸変性化合物；式(4)又は(6)のようなアミン化合物に、エチレン

オキシドやプロピレンオキシド等のアルキレンオキシドを反応させた、いわゆるアミン化合物のアルキレンオキシド付加物；これらの中から選ばれる 2 種以上の変性を組み合わせて得られるアミン化合物の変性物；等が挙げられる。

【0037】(C-1)のアミン化合物又はその誘導体としては、具体的には、摩擦特性に優れる点から、ラウリルアミン、ラウリルジェチルアミン、ラウリルジエタノールアミン、ドデシルジプロパノールアミン、パルミチルアミン、ステアリルアミン、ステアリルプロパエチレンペンタミン、オレイルアミン、オレイルプロピルジエチルオレイルイミダズリン等のアミン化合物；これらアミン化合物のアルキレンオキシド付加物；これらアミン化合物のアルキレンオキシド付加物；又はこれらの混合物等が特に好ましく用いられる。

【0038】前記(C-2)の脂肪酸エステル、脂肪酸アミド、脂肪酸イミド又は脂肪酸金属塩における脂肪酸としては、直鎖脂肪酸でも分枝脂肪酸でもよく、飽和脂肪酸でも不飽和脂肪酸でも良いが、そのアルキル基又はアルケニル基の炭素数は、6～30、好ましくは 9～24 が望ましい。および不飽和脂肪酸エステルの硫化物の炭化水素基も同様である。脂肪酸のアルキル基又はアルケニル基の炭素数が 6 未満の場合や 30 を超える場合は、温式クラッチの摩擦特性が悪化するため、それぞれ好ましくない。

【0039】この脂肪酸としては、具体的には、ヘプタン酸、オクタン酸、ノナン酸、デカン酸、ウンデカン酸、ドデカン酸、トリデカン酸、テトラデカン酸、ペンタデカン酸、ヘキサデカン酸、ヘプタデカン酸、オクタデカン酸、ノナデカン酸、イコサン酸、ヘンイコサン酸、ドコサン酸、トリコサン酸、テトラコサン酸、ペンタコサン酸、ヘキサコサン酸、ヘプタコサン酸、オクタコサン酸、ノナコサン酸、トリアコンタン酸等の飽和脂肪酸（飽和脂肪酸は直鎖状でも分枝状でも良い）；ヘプテン酸、オクテン酸、ノネン酸、デセン酸、ウンデセン酸、ドデセン酸、トリデセン酸、テトラデセン酸、ペンタデセン酸、ヘキサデセン酸、ヘプタデセン酸、オクタデセン酸、ノナデセン酸、イコセン酸、ヘンイコセン酸、ドコセン酸、トリコセン酸、テトラコセン酸、ペンタコセン酸、ヘキサコセン酸、ヘプタコセン酸、オクタコセン酸、ノナコセン酸、トリアコンタン酸等の不飽和脂肪酸（不飽和脂肪酸は直鎖状でも分枝状でも良く、また二重結合の位置も任意である）、さらには同様のアルケニル基を持つアルケニルコハク酸；等が挙げられるが、特に摩擦特性により優れる点から、ラウリン酸、ミリスチン酸、パルミチン酸、ステアリン酸、オレイン酸、各種油脂から誘導される直鎖脂肪酸（ヤシ油脂肪酸等）の直鎖脂肪酸やオキソ法等で合成される直鎖脂肪酸と分枝脂肪酸の混合物が好ましく用いられる。

19

【0047】ここで、本発明において (C) 成分として (C-1) のアミン化合物を使用する場合、前述した (B) 成分として、式 (2) の R⁴、R⁵ 若しくは R⁶ のうち 1 つ若しくは 2 つ、又は、式 (3) の R⁷、R⁸ 若しくは R⁹ のうち 1 つ若しくは 2 つが、炭素数 1～30 の炭化水素基であり、他が水素原子であるリン酸エステル (チオリン酸エステルでも良い) や亜リン酸エステル (チオ亜リン酸エステルでも良い)、特に亜リン酸エステルを併用すると、潤滑油組成物の初期なじみ性の改善効果が特に大きい。この場合、(C-1) 成分のアミン化合物と (B) 成分の上記リン酸エステル又は亜リン酸エステルは、それぞれ単独で潤滑油基油に加えても良く、また予め両者を反応させたアミン化合物とリン化合物の塩の形で潤滑油基油に加えても良い。

【0048】また、本発明の潤滑油組成物は、(D) 塩基性金属系清浄剤 (以下 (D) 成分ともいう。) は、手動または自動変速機のシクロ特性やトラクターや建設機械のブレーキ鳴き防止に必要な高い動摩擦係数 (μ_a) や低い静摩擦係数 (μ_s) を出現させる効果がある。本発明に係る (A) ポリサルファイド化合物は、単独で使用しても動摩擦係数 (μ_a) を維持しかつ静摩擦係数

(μ_s) を低減する効果を持つが、(D) 成分と併用することによりその効果が増大する。(D) 成分の塩基性金属系清浄剤の全塩基価の下限値は、 50 mg KOH/g 、好ましくは 100 mg KOH/g であり、一方、その上限値は 450 mg KOH/g である。全塩基価が 50 mg KOH/g 未満の場合は潤滑油組成物の酸化安定性が悪化し、一方、全塩基価が 450 mg KOH/g を超える場合は、潤滑油組成物の貯蔵安定性に悪影響を及ぼす恐れがあるため、それぞれ好ましくない。なおここでも言う全塩基価とは、JIS K2501「石油製品及び潤滑油—中和価試験法」の 7. に準拠して測定される過塩素酸法による全塩基価を意味している。

【0049】(D) 成分の具体例としては、例えば (D-1) 全塩基価が $50 \sim 450 \text{ mg KOH/g}$ の塩基性アルカリ土類金属サルフォネート、(D-2) 全塩基価が $50 \sim 450 \text{ mg KOH/g}$ の塩基性アルカリ土類金属フルフェネート、(D-3) 全塩基価が $50 \sim 450 \text{ mg KOH/g}$ の塩基性アルカリ土類金属サリシレート、の中から選ばれ 1 種類又は 2 種類以上の塩基性金属系清浄剤等が挙げられる。アルカリ土類金属サルフォネートとしては、より具体的には、例えば分子量 $100 \sim 1500$ 、好ましくは $200 \sim 700$ のアルキル芳香族化合物をサルフォネ化することによって得られるアルキル芳香族サルフォネ酸のアルカリ土類金属塩、特にマグネシウム塩及び/又はカルシウム塩が好ましく用いられ、アルキル芳香族サルフォネ酸としては、具体的にはいわゆる石油サルフォネ酸や合成

20

【0050】石油サルフォネ酸としては、一般に鉱油の潤滑油留分のアルキル芳香族化合物をサルフォニ化したものやホワイトオイル製造時に副生する、いわゆるマホガニ酸等が用いられる。また合成サルフォネ酸としては、例えば洗剤の原料となるアルキルベンゼン製造プラントから副生したり、ポリオレフィンをベンゼンにアルキル化することにより得られる、直鎖状や分枝状のアルキル基を有するアルキルベンゼンを原料とし、これをサルフォニ化したもの、あるいはジノニルナフタレンをサルフォニ化したもの等が用いられる。またこれらアルキル芳香族化合物をサルフォニ化する際のサルフォニ化剤としては特に制限はないが、通常、発煙硫酸や硫酸が用いられる。また、アルカリ土類金属フルフェネートとしては、より具体的には例えば、炭素数 $4 \sim 30$ 、好ましくは $6 \sim 18$ の直鎖状又は分枝状のアルキル基を少なくとも 1 個有するアルキルフルフェノール、このアルキルフルフェノールと元素硫黄を反応させて得られるアルキルフルフェノールサルファイド又はこのアルキルフルフェノールとホルムアルデヒドを反応させて得られるアルキルフルフェノールのマニシヒ反応生成物のアルカリ土類金属塩、特にマグネシウム塩及び/又はカルシウム塩が好ましく用いられる。

【0051】また、アルカリ土類金属サリシレートとしては、より具体的には例えば、炭素数 $4 \sim 30$ 、好ましくは $6 \sim 18$ の直鎖状又は分枝状のアルキル基を少なくとも 1 個有するアルキルサリチル酸のアルカリ土類金属塩、特にマグネシウム塩及び/又はカルシウム塩が好ましく用いられる。(D-1) 塩基性アルカリ土類金属フルフェネート、(D-2) 塩基性アルカリ土類金属フルフェネート及び (D-3) 塩基性アルカリ土類金属サリシレートには、その全塩基価が $50 \sim 450 \text{ mg KOH/g}$ の範囲にある限りにおいて、アルキル芳香族サルフォネ酸、アルキルフルフェノール、アルキルフルフェノールサルファイド、アルキルフルフェノールのマニシヒ反応生成物、アルキルサリチル酸等を、直接、マグネシウム及び/又はカルシウムのアルカリ土類金属の酸化物や水酸化物等のアルカリ土類金属塩基と反応させたり、又は一度ナトリウム塩やカリウム塩基とのアルカリ金属塩としてからアルカリ土類金属塩と置換させること等により得られる中性塩 (正塩) を過剰のアルカリ土類金属塩やアルカリ土類金属塩基 (アルカリ土類金属の水酸化物や酸化物) を水の存在下で加熱することにより得られる塩基性塩や、炭酸ガスの存在下で中性塩 (正塩) をアルカリ土類金属の塩基と反応させることにより得られる過塩基性塩 (超塩基性塩) が含まれる。なお、これらの反応は、通常、溶媒 (ヘキサン等の脂肪族炭化水素溶剤、キシレン等の芳香族炭化水素溶剤、軽質潤滑油基油等) 中で行われる。また、金属系清浄剤は通常、軽質潤滑油基油等で希釈された状態で市販されており、また、入手可能であるが、一般的に、その金属含有量が $1.0 \sim 2.0$ 質量%、好ま

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+ (F)、
 (6) 基油 + (A) + (B) + (D) + (E) 又は
 (F)、
 (7) 基油 + (A) + (B) + (D) + (E) +
 (F)。

その他の好ましい組成としては、(A) 成分の他に
 (E) 成分を含む組成が好ましく、以下の態様が挙げら
 れる。

(8) 基油 + (A) + (E)、
 (9) 基油 + (A) + (E) + (C) 又は (D) 又は
 (F)、
 (10) 基油 + (A) + (D) + (E) + (C) 又は
 (F)、
 (11) 基油 + (A) + (C) + (D) + (E) +
 (F)。

【0067】本発明の潤滑油組成物においては、その性
 能を更に向上させる目的で、必要に応じて、さらに粘度
 指数向上剤、流動点降下剤、酸化防止剤、極圧添加剤、
 腐蝕防止剤、ゴム膨潤剤、消泡剤、着色剤等に代表され
 る各種添加剤を単独で、又は数種類組み合わせて含有さ
 せても良い。粘度指数向上剤としては、具体的には、各
 種メタクリル酸エステルから選ばれる1種又は2種以上
 のモノマーの重合体若しくは共重合体、又はその水添物
 などのいわゆる非分散型粘度指数向上剤、あるいはさら
 に窒素化合物を含む各種メタクリル酸エステルを共重
 合せたいわゆる分散型粘度指数向上剤等が例示できる。
 他の粘度指数向上剤の具体例としては、非分散型又は分
 散型エチレン・α-オレフィン共重合体(α-オレフィ
 ンとしてはプロピレン、1-ブテン、1-ペンテン等が
 挙げられる)、又はその水素化物、ポリイソブチレン、
 又はその水添物、スチレン-ジエチン水素化共重合体、ス
 チレン-無水マレイン酸エステル共重合体、ポリアルキ
 ルスチレン等が例示できる。

【0068】これら粘度指数向上剤の分子量は、せん断
 安定性を考慮して選定することが必要である。具体的に
 は、粘度指数向上剤の数平均分子量は、例えば分散型及
 び非分散型ポリメタクリレートの場合では、5,000
 ～150,000、好ましくは5,000～35,000
 のものが、ポリイソブチレン又はその水素化物の場合
 は800～5,000、好ましくは1,000～4,000
 のものが、エチレン・α-オレフィン共重合体又は
 その水素化物の場合は800～150,000、好まし
 くは3,000～12,000のものが好ましい。また
 これら粘度指数向上剤の中にもエチレン・α-オレフィ
 ン共重合体又はその水素化物を用いた場合には、特にせ
 ん断安定性に優れた潤滑油組成物を得ることができ
 る。

【0069】これらの中から任意に選ばれた1種類ある
 いは2種類以上の化合物は、任意の量を含有させること
 ができるが、通常、その含有量は、潤滑油組成物全量基
 準0.1～40.0質量%であるのが望ましい。酸化防

止剤としては、フェノール系化合物やアミン系化合物
 等、潤滑油に一般的に使用されているものであれば使用
 可能である。具体的には、2,6-ジ-tert-ブチ
 ル-4-メチルフェノール等のアルキルフェノール類、
 メチレン-4,4'-ビスフェノール(2,6-ジ-tert-
 e-ブチル-4-メチルフェノール)等のビスフェノ
 ール類、フェニル-α-ナフチルアミン等のナフチルア
 ミン類、ジアルキルジフェニルアミン類、(3,5-ジ-
 tert-ブチル-4-ヒドロキシフェニル)プロピ
 オン酸等の(3,5-ジ-tert-ブチル-4-ヒド
 ロキシフェニル)脂肪酸類と1価又は多価アルコール
 (例えば、メタノール、オクタデカノール、1,6-ヘ
 キサボリサルファイド、ネオペンチルグリコール、チオ
 ジエチレングリコール、トリエチレングリコール、ペン
 タエリスリトール等)とのエステル等が挙げられる。こ
 れらの中から任意に選ばれた1種類あるいは2種類以上
 の化合物は、任意の量を含有させることができるが、通
 常、その含有量は、潤滑油組成物全量基準で0.01～
 5.0質量%であるのが望ましい。

【0070】極圧添加剤として、本発明の必須成分であ
 る(A)成分のポリサルファイド化合物の他は、例え
 ば、ジスルファイド類、硫化油脂類等の硫黄系化合物等が
 挙げられる。これらの中から任意に選ばれた1種類ある
 いは2種類以上の化合物は、任意の量を含有させること
 ができるが、通常、その含有量は、潤滑油組成物全量基
 準で0.01～5.0質量%であるのが望ましい。腐食
 防止剤としては、例えば、ペンゾトリアゾール系、チア
 ジアゾール系、イミダゾール系化合物等が挙げられる。
 これらの中から任意に選ばれた1種類あるいは2種類以
 上の化合物は、任意の量を含有させることができるが、
 通常、その含有量は、潤滑油組成物全量基準で0.01
 ～3.0質量%であるのが望ましい。消泡剤としては、
 例えば、ジメチルシリコーン、フルオロシリコーン等の
 シリコーン類が挙げられる。これらの中から任意に選ば
 れた1種類あるいは2種類以上の化合物は、任意の量を
 含有させることができるが、通常、その含有量は、潤滑
 油組成物全量基準で0.001～0.05質量%である
 のが望ましい。着色剤は任意の量を含有させることがで
 きるが、通常、その含有量は、潤滑油組成物全量基準で
 0.001～1.0質量%であるのが望ましい。

【0071】

【発明の効果】以上のように、本発明の潤滑油組成物は
 優れた極圧性および摩摺特性を有しており、特に、シ
 クロナイザリングを使用した手動または自動変速機用潤
 滑油や、トラクタや建設機械に使用される変速機とブ
 レーキを同時に潤滑する共通潤滑油等の動力伝達
 機構用の潤滑油としての使用に適している。

【0072】

【実施例】以下、本発明の内容を具体例及び比較例によ
 りさらに具体的に説明するが、本発明はこれらによりな

んら限定されるものではない。

【0073】試験1]手動または自動変速機で使用されるシシクロロナイザリングやトラクターで使用される湿式ブレーキの材質である銅合金における摩擦特性を評価するたため、表1に示す潤滑油組成物について、以下に示すシシクロロ摩擦試験の運転条件

シシクロロナイザリング：国産手動変速機用銅合金シシクロロナイザリング

ギヤコーン：国産手動自動変速機用鋼製ギヤコーン

油 温：80℃

モーター回転数：1200rpm

押しつけ荷重：400N

押しつけサイクル：ON 0.5 sec/OFF 1.0 sec

【0075】

【表1】

	組成 [質量%]		(A) 成分	シシクロ 摩擦試験 μ ₁₂₀₀ ⁷⁾
	(A) 成分を 除く潤滑油			
実施例 1	精製鉱油 A ¹⁾	ポリサルファイド化合物 A ⁴⁾ [0.5] ⁸⁾	0.091	
実施例 2	精製鉱油 A ¹⁾	ポリサルファイド化合物 B ⁵⁾ [0.5] ⁸⁾	0.098	
比較例 1	精製鉱油 A ¹⁾	—	0.085	
比較例 2	精製鉱油 A ¹⁾	ポリサルファイド化合物 C ⁶⁾ [0.5] ⁸⁾	0.086	
実施例 3	潤滑油 A ²⁾	ポリサルファイド化合物 A ⁴⁾ [0.5] ⁸⁾	0.094	
実施例 4	潤滑油 A ²⁾	ポリサルファイド化合物 B ⁵⁾ [0.5] ⁸⁾	0.096	
比較例 3	潤滑油 A ²⁾	ポリサルファイド化合物 C ⁶⁾ [0.5] ⁸⁾	0.052	
実施例 5	潤滑油 B ³⁾	ポリサルファイド化合物 A ⁴⁾ [0.5] ⁸⁾	0.090	
実施例 6	潤滑油 B ³⁾	ポリサルファイド化合物 B ⁵⁾ [0.5] ⁸⁾	0.092	
比較例 4	潤滑油 B ³⁾	ポリサルファイド化合物 C ⁶⁾ [0.5] ⁸⁾	0.042	

【0076】1) 精製鉱油A：動粘度4.1mm²/s (@100℃)、粘度指数123のパラフィン系水素化分解潤滑油。

2) 潤滑油A：精製鉱油Aに、組成物全量基準でポリメタクリレート20質量%、ジエチルヘキシル酸性リン酸エステルアミン塩0.3質量%、チアジエンール0.2質量%を添加した動粘度13.6mm²/s (@100℃)の潤滑油。

3) 潤滑油B：精製鉱油Aに、組成物全量基準でポリメタクリレート20質量%、ジブチル重リン酸エステル0.2質量%、塩基性ブライマリーZnDTP1.2質量%、TBN300Caスルフォネート2.0質量%、アルケニルコハク酸イミド0.5質量%、ソルビタンモノオレート0.3質量%を添加した動粘度14.8mm²/s (@100℃)の潤滑油。

4) ポリサルファイド化合物A：式(1)において、R¹、R²の炭素数8、n=0~1、x、y=3~9のポリサルファイド化合物。

条件でシシクロ摩擦試験を行い、なじみ運転1000サイクル経過後の静摩擦係数 μ_s 。 μ_s はシシクロナイザリングが静止状態から1rpmでスリッピング開始後の最大摩擦係数を示す。)を測定した。

【0074】

5) ポリサルファイド化合物B：式(1)において、R¹、R²の炭素数16または18、n=0~1、x、y=1~9のポリサルファイド化合物。

6) ポリサルファイド化合物C：式(1)において、R¹、R²の炭素数4、n=0~1、x、y=2~13のポリサルファイド化合物。

7) μ_{1200} ：1000サイクル後の1200rpmの摩擦係数。

8) [0.5]：ポリサルファイド化合物を組成物全量基準で硫黄0.5質量%となるよう添加した。

【0077】表1の結果から明らかなとおり、本発明に係る(A)ポリサルファイド化合物を含有する実施例の潤滑油組成物は、手動または自動変速機のシシクロメッシュ機構やトラクターの湿式ブレーキで用いられる銅合金での動摩擦係数 μ_{1200} が高く、シシクロメッシュ型手動または自動変速機でのギヤ鳴りの原因となるシシクロ時の摩擦係数の低下を防ぐことができる。

50 【0078】[試験2]本発明の潤滑油組成物について

て、摩擦特性への影響を評価するため、表 1 に示した各組成の静摩擦係数 μ_s をシנקロ摩擦試験機で測定しシ

た。その結果を表 2 に示した。

【0079】

シנקロ摩擦試験の運転条件

シנקロナイザリング：国産手動変速機用銅合金シנקロナイザリングギヤコーン

油 温：80℃

モーター回転数

押しつけ荷重

押しつけサイクル

：慣性吸収試験後 1 r p m

：400 N

：ON 2.0 sec / OFF 5.0 sec

【0080】

10 【表 2】

	組成 [質量%]		シנקロ 摩擦試験 μ_s
	(A) 成分を 除く潤滑油	(A) 成分	
実施例 7	精製鉱油 A ¹⁾	ポリサルファイド化合物 A ⁴⁾ [0.5] ₈₎	0.158
実施例 8	精製鉱油 A ¹⁾	ポリサルファイド化合物 B ⁵⁾ [0.5] ₈₎	0.112
比較例 5	精製鉱油 A ¹⁾	—	0.169
比較例 6	精製鉱油 A ¹⁾	ポリサルファイド化合物 C ⁶⁾ [0.5] ₈₎	0.173
実施例 9	潤滑油 A ²⁾	ポリサルファイド化合物 A ⁴⁾ [0.5] ₈₎	0.152
実施例 10	潤滑油 A ²⁾	ポリサルファイド化合物 B ⁵⁾ [0.5] ₈₎	0.103
比較例 7	潤滑油 A ²⁾	ポリサルファイド化合物 C ⁶⁾ [0.5] ₈₎	0.162
実施例 11	潤滑油 B ³⁾	ポリサルファイド化合物 A ⁴⁾ [0.5] ₈₎	0.140
実施例 12	潤滑油 B ³⁾	ポリサルファイド化合物 B ⁵⁾ [0.5] ₈₎	0.096
比較例 8	潤滑油 B ³⁾	ポリサルファイド化合物 C ⁶⁾ [0.5] ₈₎	0.165

【0081】 1) 精製鉱油 A：表 1 の精製鉱油 A と同 30 ブレーキでのブレーキ鳴き防止に有効なことを示している。

2) 潤滑油 A：表 1 の潤滑油 A と同一。

3) 潤滑油 B：表 1 の潤滑油 B と同一。

4) ポリサルファイド化合物 A：表 1 のポリサルファイド化合物 A と同一。

5) ポリサルファイド化合物 B：表 1 のポリサルファイド化合物 B と同一。

6) ポリサルファイド化合物 C：表 1 のポリサルファイド化合物 C と同一。

7) μ_s ：慣性吸収試験後 100 サイクル後の 1 r p m 40 の最大摩擦係数。

8) [0.5]：ポリサルファイド化合物を組成物全量基準で硫黄 0.5 質量% となるよう添加した。

【0082】 表 2 の結果から明らかなとおり、本発明の潤滑油組成物において、特に式 (1) における R' ～ R³ が長鎖のポリサルファイド化合物 B を用いた実施例 8、10 および 12 は対応する比較例 5 ～ 8 に比較して著しく低い μ_s を示す。これは低滑り速度での摩擦係数が低いことを意味し、手動または自動変速機のシנקロメッシュ機構でのひっかかり現象の防止やトラクターの湿式

【0083】 本発明に係る潤滑油組成物による、トラクターのブレーキ鳴きへの影響を評価するた

め、表 3 に示す組成を有する実施例 13 及び比較例 9 の潤滑油組成物について、以下に示す条件で、油温が 5℃ 及び油温が外気温と同一の場合のトラクターブレーキ鳴き試験を行い、その結果を表 3 に示した。

【0084】 トラクターブレーキ鳴き試験

(1) 使用トラクター：15 馬力トラクター
(2) 試験方法：まず試験油を充填したトラクターを 1 時間以上低温室 (0℃) にて冷やす。低温室から出したトラクターを暖気なしで時速 30 km に加速しフルブレーキをかけ音の発生を聞いた後油温を測定する。これを 2 度繰り返して 5℃ の試験とする。さらに走行を繰り返して油温が 30℃ に達したところでフルブレーキをかけ音の発生を聞く。これを 2 度繰り返して外気温の試験とする。

【0085】

【表 3】

31

組成		実施例 13	比較例 9
ブレーキ鳴き試験	潤滑油	潤滑油 C ¹⁾	潤滑油 C ¹⁾
	(A) 成分	ポリサルファイド化合物 B ²⁾ [O. 5] ⁴⁾	ポリサルファイド化合物 C ³⁾ [O. 5] ⁴⁾
	油温 5℃	鳴き小	鳴き大
	油温 外気温	鳴きなし	鳴き中

【0086】 1) 潤滑油 C : 精製鉱油 A に、組成物全量基準でポリメタクリレート 7.5 質量%、塩基性アライマリー ZnDTP 1.8 質量%、TBN100Ca スルフォネート 2.0 質量%、TBN300Ca スルフォネート 1.5 質量%、オレイルアミド 0.1 質量% を添加した動粘度 9.1 mm²/s (@100℃) の潤滑油。
2) ポリサルファイド化合物 B : 表 1 のポリサルファイド化合物 B と同一。

3) ポリサルファイド化合物 C : 表 1 のポリサルファイド化合物 C と同一。
4) 【O. 5】 : ポリサルファイド化合物を組成物全量基準で硫黄 0.5 質量% となるよう添加した。
【0087】 表 3 の結果から明らかとなり、本発明の潤滑油組成物 (実施例 13) は、トラクターのブレーキ鳴きの防止効果に優れることがわかる。

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